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PHOTOGRAPHIC INTERPRETATION REPORT

[redacted] HARDENED CENTRAL COMMAND FACILITIES MOSKVA AREA, USSR

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SEPTEMBER 1966
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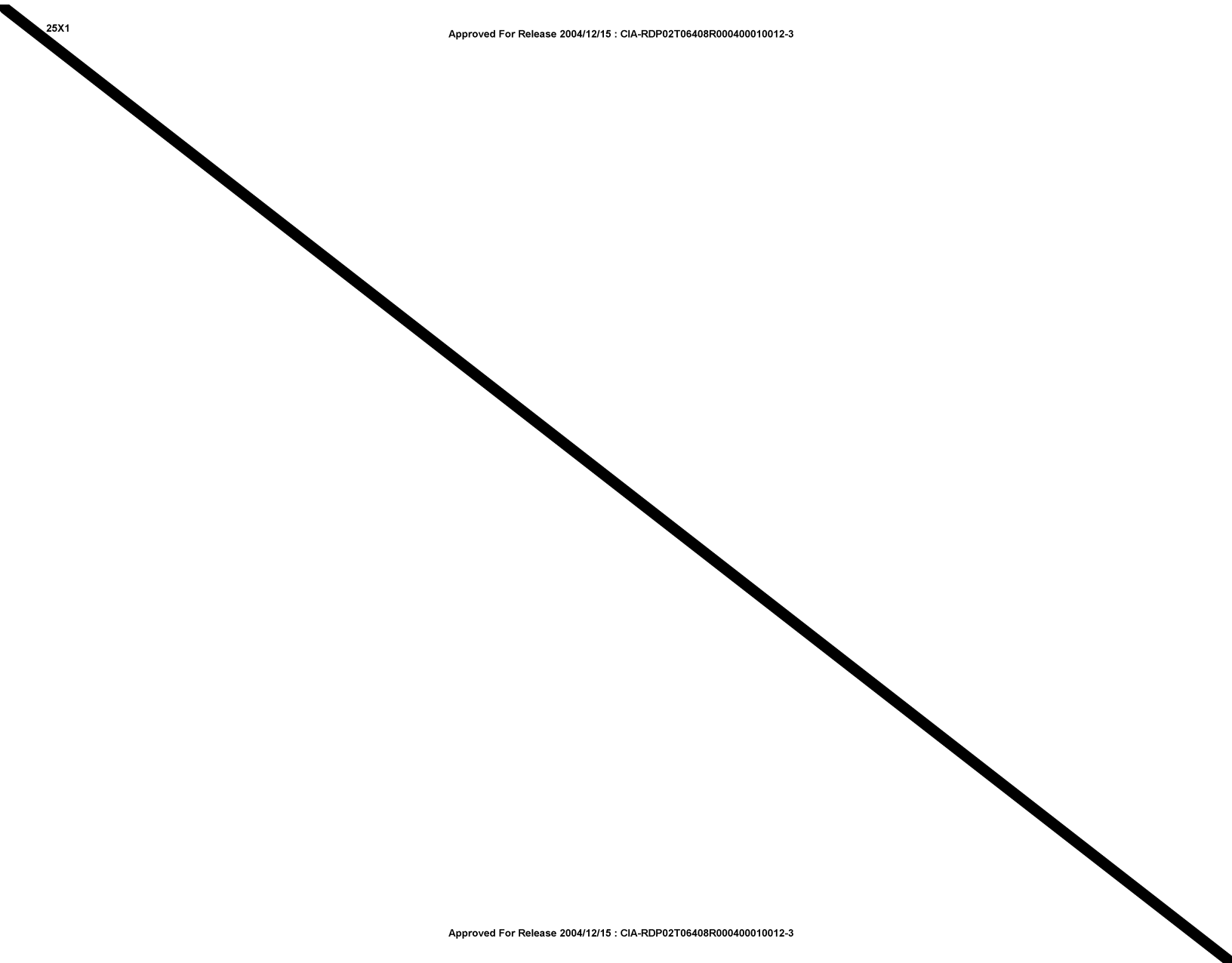

PHOTOGRAPHIC INTERPRETATION REPORT

HARDENED CENTRAL COMMAND FACILITIES MOSKVA AREA, USSR

SEPTEMBER 1966

NATIONAL PHOTOGRAPHIC INTERPRETATION CENTER

SUMMARY

This report describes several facilities in the Moskva area that have been determined to be Central Command Facilities (Figure 1). Supporting evidence is included herein which shows that several of these facilities are probably Soviet Rocket Force (SRF) associated and the remainder, if not SRF, are associated with an undetermined communications system of equal national importance.

The facilities described herein are presented under 3 general categories: 1) Central Command Communications Facilities, HF antenna fields from which communications are relayed, 2) Central Command Operations or Headquarters Facilities, areas in which command decisions are made, and 3) significant HF Communications Facilities which contain earth-mounded buildings surrounded by HF antennas.

A special section on hardened (subsurface) antennas is included in Appendix A of this report. This type of antenna was one of the primary recognition features for the identification of the centers included in this report and special attention is invited to this appendix.

INTRODUCTION

This report has been prepared in response to CIA requirement CIA/ORR/C-RR4-81798 [redacted] All of these requirements have a common theme: locate and identify the SRF command and control communications links. The search was to include the communications facilities at the launch sites, at the intermediate or regional levels, and finally, at the central command facilities in the Moskva area. To date, back-up HF communications facilities have been identified at 14 SRF probable regional headquarters facilities, approximately 97 percent of the deployed MRBM/IRBM complexes in the USSR, and at 50 percent of the ICBM complexes. Thirteen of these sites have previously been reported by NPIC. 1,2,3,4,5/ This report is a study of all available photography of the Moskva area to satisfy the final and most complicated portion of these requirements, the identification of the SRF Central Command Facilities

The techniques and criteria used in identifying the SRF command facilities in the Moskva area are principally based upon the following similarities noted in a comparison of the previously identified communications facilities at the launch points and at the intermediate or regional levels:

1. The communications facilities appear to be similar. The launch sites and regional facilities have an earth-mounded control building with 2 or more hardened antennas near the building and contain rhombic, fishbone, and other HF antennas peripheral to the site. Only those communications facilities in the Moskva area with these similar features are included in this report.

2. The field facilities and those in the Moskva area parallel each other in time, type, and sequence of construction, including the installation of the hardened (subsurface) antennas.

3. Azimuthal projections of the antennas in the Moskva area give good coverage of the MRBM, IRBM, and ICBM launch sites. Although there is more than one HF antenna field in the Moskva area which satisfies this condition, the 3 Central Command Communications Facilities described herein each provides adequate coverage of the MRBM, IRBM, and ICBM launch complexes and each contains hardened (subsurface) antennas.

4. Two of the 3 command communications facilities have been operational communications sites composed of a large control building surrounded by rhombic, dipole, and vee antennas. After being operational an undetermined period of time, 2 additional antenna sites were constructed near each of the original antenna sites. Each of these new sites is composed of a large earth-mounded control building which is surrounded by rhombic, dipole, vee, and hardened (subsurface) antennas and each of the new sites contains more antennas than the original site. At this time, all 3 facilities are operational.

A probable SRF Central Command Communications Facility (transmitting) is 2 nautical miles (nm) south of Novopetrovskoye, and approximately 38.5 nm west-northwest of Moskva at 55-57-30N 036-28-10E. A counterpart, the receiving site, is 3.5 nm southeast of Naro-Fominsk and 43 nm southwest of Moskva at 55-20-05N 036-47-30E. An additional HF receiving site of unidentified function, contains hardened (subsurface) antennas, and is 21 nm southeast of Moskva, near Ramenskoye at 55-31-00N 038-03-20E. Three other sites, containing earth-mounded buildings but not hardened antennas, are reported, but not analyzed in detail in this report. They are Kryukovo HF Communications Facility, 22 nm northwest of Moskva at 56-05N 037-06E; Poselok HF Communications Facility, 26 nm northwest of

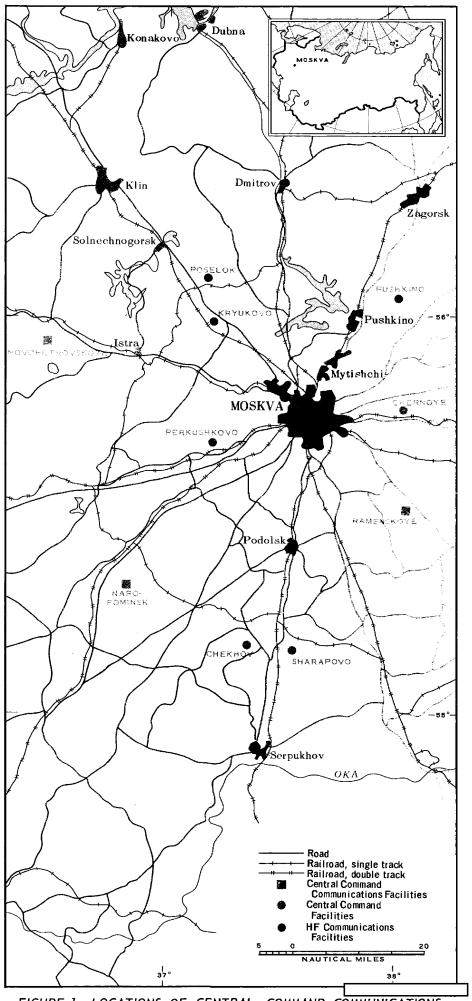

FIGURE 1. LOCATIONS OF CENTRAL COMMAND COMMUNICATIONS FACILITIES.

FIGURE 2. NOVOPETROVSKOYE PROBABLE SRF CENTRAL COMMAND COMMUNICATIONS FACILITY (TRANSMITTING).

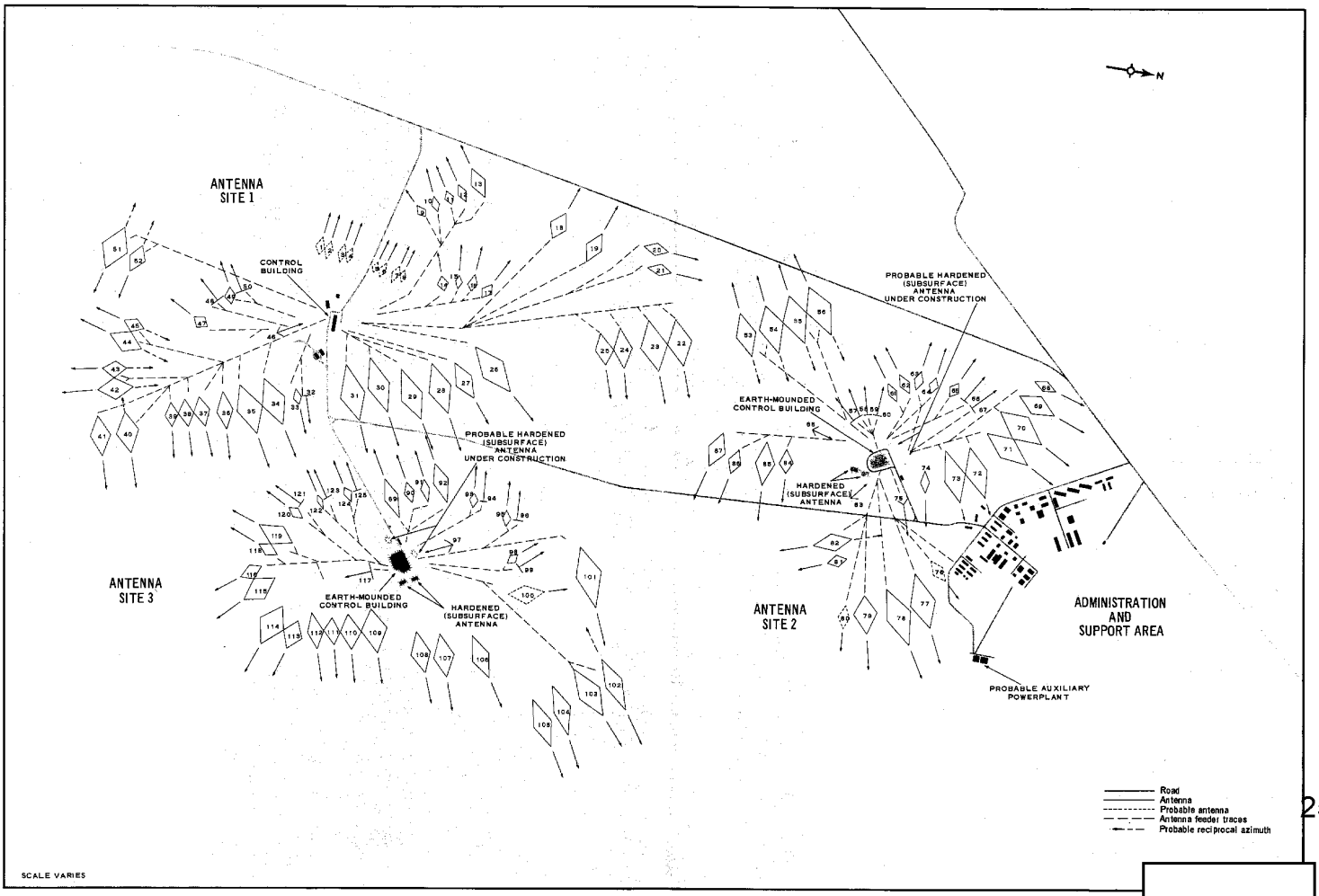

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FIGURE 3. LAYOUT OF NOVOPETROVSKOYE PROBABLE SRF CENTRAL COMMAND COMMUNICATIONS FACILITY (TRANSMITTING).

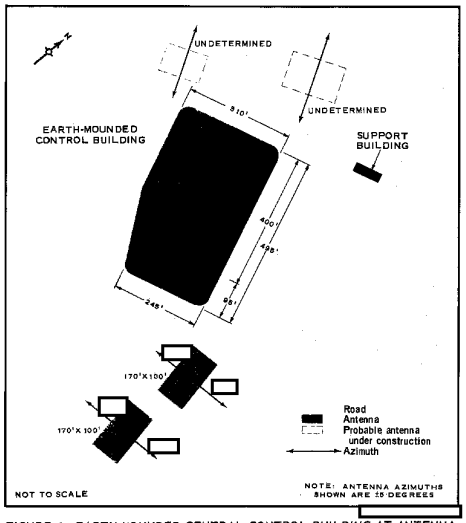

FIGURE 4. EARTH-MOUNDED CENTRAL CONTROL BUILDING AT ANTENNA SITE 2, NOVOPETROVSKOYE.

Moskva at 56-05N 037-06E; and Pushkino HF Communications Facility, 23 nm northeast of Moskva at 56-03N 038-02E.

The Central Command Facilities are: 1) near Perkhushkovo, approximately 15 nm southwest of Moskva at 55-36-10N 037-11-20E; 2) near Chernoye, approximately 25 nm east of Moskva at 55-46-10N 038-02-25E; 3) near Sharapovo, approximately 35 nm south of Moskva at 55-10-00N 037-33-30E; and 4) near Chekhov, approximately 36 nm south-southwest of Moskva at 55-10-10N 037-10-00E. It is not possible, at this time, to associate these command facilities with the SRF.

CENTRAL COMMAND COMMUNICATIONS FACILITIES

Novopetrovskoye Probable SRF Central Command Communications Facility (Transmitting)

This secured, road-served facility (Figures 2, 3, 4, and 5) is concealed from ground observation by trees and is approximately 4.5 square miles in area. The components of this facility include an administration and support area containing approximately 50 buildings and 3 HF antenna fields designated Antenna Sites 1, 2, and 3. Together, the 3 HF antenna fields contain a total of 125 aboveground rhombic, dipole, and vee HF antennas. In addition, there are 4 hardened (subsurface) and at least 4 probable hardened (subsurface) antennas under construction.

Antenna Site 1 has an aboveground control building and associated antennas that predate the construction of the SRF HF back-up communications facilities. Antenna Sites 2 and 3 both have hardened (subsurface) antennas and earth-mounded control buildings, and were constructed during the same time frame as those at the missile launch complexes.

Antenna Site 1. Antenna Site 1 (Figures 2 and 3) contains a large rectangular control building, approximately 320 feet long and 55 feet wide, and is surrounded by approximately 32 double rhombic antennas, approximately 16 single rhombic antennas, 3 dipole antennas, and 1 vee antenna. The rhombic antenna clearings vary in length from approximately 300 feet to approximately 1,250 feet. The width of the antenna clearings cannot be determined from available photography.

This was the original communications site in this facility and was first observed on photography from [redacted] At that time, the central control building, a smaller rectangular building, and from 5 to 10 probable antenna clearings were visible. Mission [redacted] photography shows continued construction in the form of at least 4 new secondary buildings, heavy track activity, numerous probable stacks of construction materials, and at least 35 rhombic antenna clearings. [redacted] photography indicated that 2 new secondary buildings had been added and at least 3 of the older secondary buildings had been removed. There were also 8 new probable rhombic antennas under construction. No identifiable security fencing has been observed around this antenna site.

Antenna Site 2. Antenna Site 2 (Figures 2, 3, and 4) contains a very large earth-mounded control building which is basically rectangular in shape, but with an annex on one end. The overall dimension of the control building and annex are approximately 495 feet by 310 feet, with the main building approximately 400 feet by 310 feet, and the annex approximately 245 by 95 feet. On the top of the main building are 2 or 3 raised, unidentified structures which are probably associated with the ventilation system. The control building (Figures 3 and 4) is surrounded by 2 hardened (subsurface) antennas, 2 probable hardened (subsurface) antennas under construction, 18 probable double rhombic antennas, 9 single rhombic antennas including 6 probable rhombic antennas, 6 dipole antennas, and 3 vee antennas. The rhombic antenna clearings vary in length from approximately 350 feet to approximately 1,300 feet.

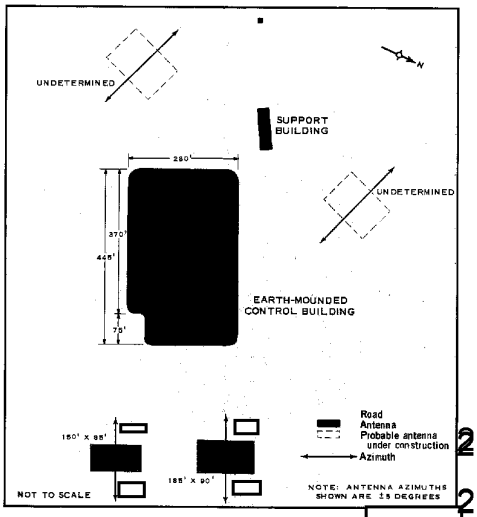

FIGURE 5. EARTH-MOUNDED CENTRAL CONTROL BUILDING AT ANTENNA SITE 3, NOVOPETROVSKOYE.

This site was first observed on [redacted] photography. At that time, only a small clearing containing a single small building was observed; no antenna clearings or construction activity were evident. On [redacted] photography, the clearings had been enlarged, and a building appeared to be under construction in the excavation. Also, there were at least 9 rhombic antenna clearings either complete or under construction. On [redacted] photography, all or nearly all of the antenna clearings appeared to be complete; construction activity was continuing on the control

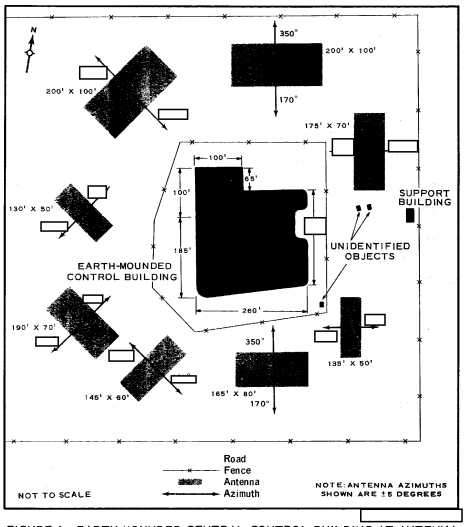

FIGURE 6. EARTH-MOUNDED CENTRAL CONTROL BUILDING AT ANTENNA SITE 2, NARO-FOMINSK.

building; and an annex was under construction on the southeast side of the control building. On [redacted] photography, the earth mounding of the control building apparently had not begun, but on [redacted] photography, the next coverage, the structure was at least partially, if not completely, earth mounded. On Mission [redacted] photography, the earth mounding was definitely complete, there still appeared to be some construction debris to be removed, and construction was started on the hardened (subsurface) antennas. No identifiable security fencing was observed around this antenna site.

Antenna Site 3. Antenna Site 3 (Figures 3 and 5) contains a large earth-mounded control building similar to the one at Antenna Site 2. The overall dimensions of the earth-mounded building and the earth-mounded annex are approximately 445 feet by 285 feet; the main building is approximately 370 by 280 feet and the annex is approximately 160 by 75 feet. On the top of the main building are at least 2 or possibly 3 of the same type of raised unidentified structures as are on the building at Antenna Site 2. The central control building is surrounded by 2 hardened (subsurface) antennas, at least 2 probable hardened (subsurface) antennas under construction, 28 double rhombic antennas including 14 probable double rhombic antennas, 1 probable single rhombic antenna, 7 dipole antennas, and 1 vee antenna. The double rhombic antennas vary in length from approximately 350 feet to approximately 1,200 feet.

This site was first observed on [redacted] photography, at which time only a secondary access road and a clearing for the control building were visible. On [redacted] photography, the control building was under construction within an excavation and at least 25 of the antenna clearings had been completed. [redacted] photography indicates that the earth mounding is probably complete on the control building, 1 HF antenna is under construction, and construction has been started on the hardened (subsurface) antennas similar to those present at Antenna Site 2. No identifiable security fencing can be observed around the antenna site.

Administration and Support Area. The Administration and Support Area (Figures 2 and 3) contains at least 55 buildings of various sizes and functions. The earliest available photographic coverage of the area is on [redacted] which was of such poor interpretability that it is not possible to distinguish the buildings clearly. On [redacted] photography, the coverage is of somewhat better interpretability and there are at least 18 buildings visible. On [redacted] photography, the Administration and Support Area appeared to be very nearly complete. A probable auxiliary powerplant, complete with an earth-mounded fuel-storage facility, was under construction on the eastern edge of the Administration and Support Area.

A construction chronology of this facility is included in Appendix B. This chronology is followed by maps showing the approximate azimuth projections of the HF antennas and antenna groups (Figure 31), the approximate azimuth projections of the hardened (subsurface) antennas (Figure 32), and Table 1 which contains the antenna azimuths, designations, types, and possible correspondents.

Naro-Fominsk Probable SRF Central Command Communications Facility (Receiving)

This secured, road-served facility (Figures 6, 7, 8, 9, 10, and 11) is concealed from ground observation by trees

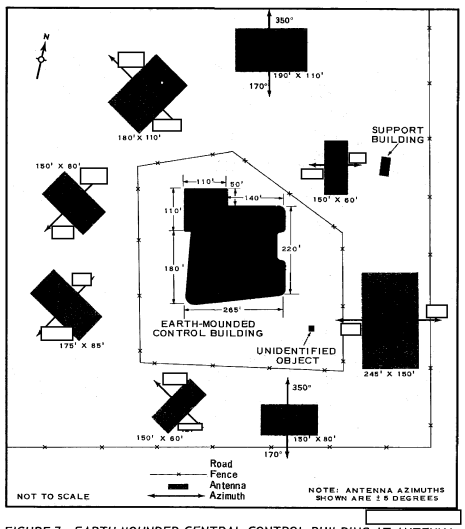

FIGURE 7. EARTH-MOUNDED CENTRAL CONTROL BUILDING AT ANTENNA SITE 3, NARO-FOMINSK.

and is approximately 2 square miles in area. It contains 3 HF antenna fields designated Antenna Sites 1, 2, and 3, and an Administration and Support Area with at least 55 buildings of various sizes and functions. The antennas include 51 fishbone receiving and dipole antennas and 16 hardened (subsurface) antennas.

Within Antenna Site 1 is an aboveground control building similar in appearance to the control building at Novopetrovskoye Antenna Site 1. The antennas surrounding the control building predate the SRF HF back-up communications facilities at deployed missile sites. Antenna Sites 2 and 3 were constructed during the same time as the SRF HF back-up communications facilities.

Antenna Site 1. Antenna Site 1 (Figures 8 and 9) contains 10 fishbone and 6 horizontal dipole antennas including 2 possible horizontal dipole antennas. Antenna number 4 on Figure 9 is a long-distance fishbone receiving antenna and the remainder of the antennas in this site are short- and medium-distance dipole and fishbone antennas. This, the original antenna site in this facility, was first observed on [redacted] photography.

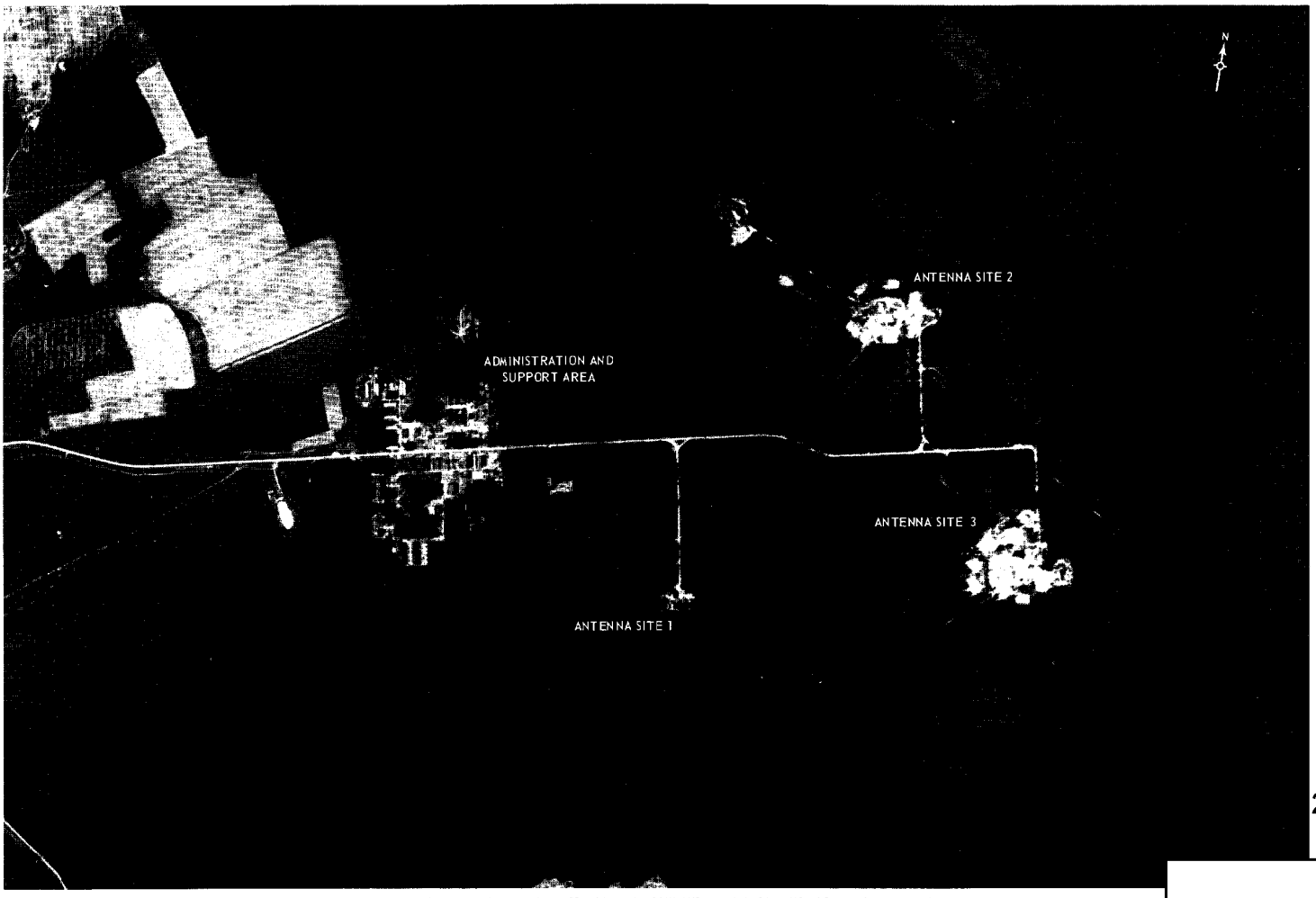

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FIGURE 8. NARO-FOMINSK PROBABLE SRF CENTRAL COMMAND COMMUNICATIONS FACILITY (RECEIVING).

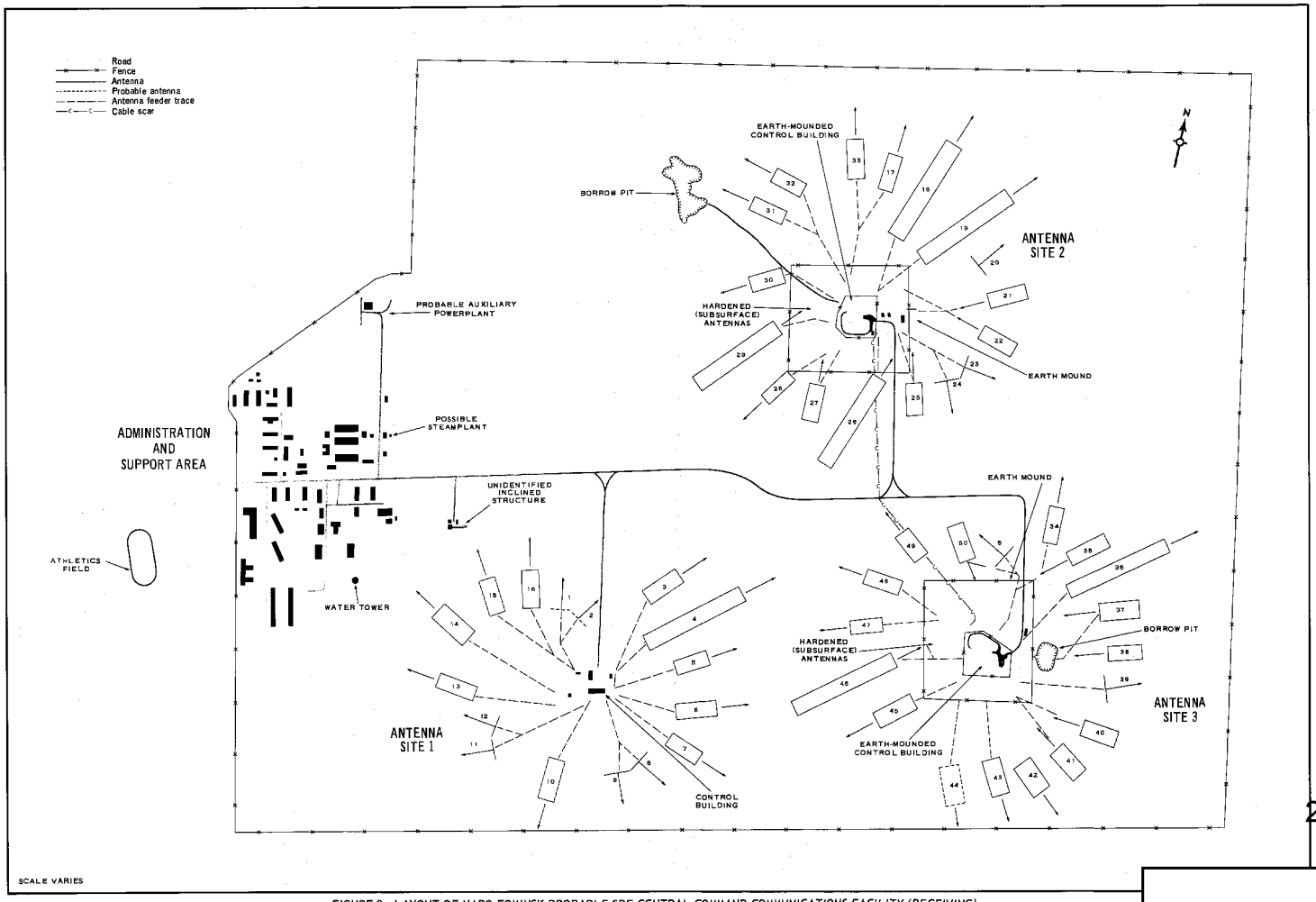

FIGURE 9. LAYOUT OF NARO-FOMINSK PROBABLE SRF CENTRAL COMMAND COMMUNICATIONS FACILITY (RECEIVING).

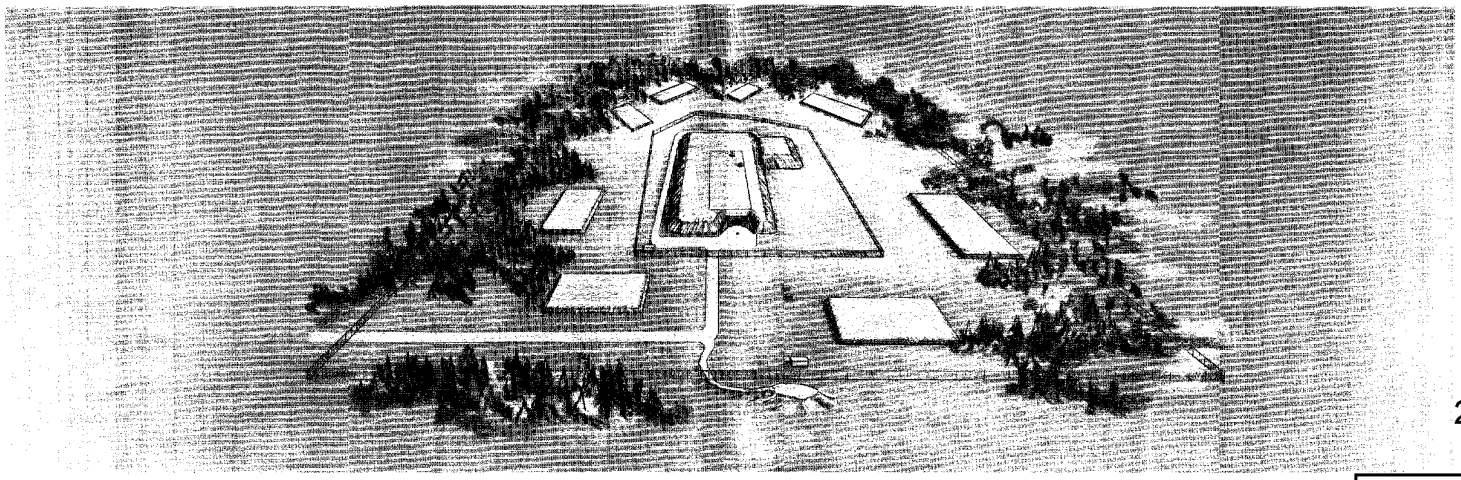

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FIGURE 10. PERSPECTIVE VIEW OF ANTENNA SITE 2, NARO-FOMINSK.

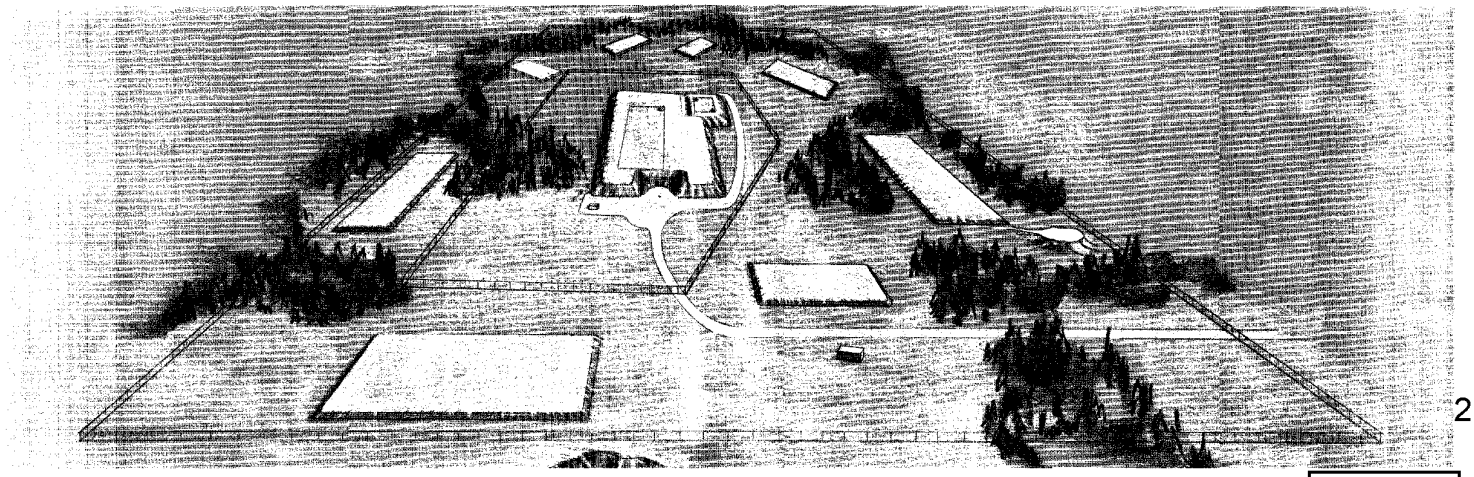

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FIGURE 11. PERSPECTIVE VIEW OF ANTENNA SITE 3, NARO-FOMINSK.

This mission revealed at least 10 antenna clearings arranged in a radial pattern around a control building approximately 180 feet by 40 feet. Two very small support buildings and 2 possible switching buildings were apparent on subsequent photography. Little or no apparent change has been observed at this site since the identification of the initial antenna pattern.

Antenna Site 2. Antenna Site 2 (Figures 8 and 9) contains a very large earth-mounded control building (Figures 6 and 10) which is basically rectangular in shape, but with an annex on one end. The overall dimensions of the control building and annex are approximately 285 feet by 260 feet, with the main building approximately [redacted] and the annex approximately 100 by 100 feet. The earth-mounded control building is surrounded by 8 hardened (subsurface) antennas, 14 fishbone receiving antennas, and 3 horizontal dipole antennas. Earth scarring in the area where an earth-mounded building was subsequently constructed may be observed on [redacted] photography. The control building is double fenced; the outer or perimeter security fence was constructed around the area of the control building during an early stage of construction; the inner security fence surrounds the control building and the loop service road. Eight hardened (subsurface) antennas are arranged in a symetrical pattern around the control building, between the 2 fences. No guard or light towers have been identified. Antennas numbered 29, 19 and 18, 26 on Figure 9 are paired long-distance fishbone antennas. Some of the other 13 fishbone antennas are also paired. The dipole antennas are of the short- and medium-distance type. The small rectangular building that is on the access road and in front of the earth-mounded control building appeared at approximately the same time as the radial antenna pattern. It is possible that this structure was used for operational testing of the communications equipment while the earth-mounded building was under construction.

Antenna Site 3. Antenna Site 3 (Figures 8 and 9) is similar in appearance and development to Antenna Site 2, and contains a very large earth-mounded, control building with an annex on one end (Figures 7 and 11). The overall dimensions of the control building and annex are approximately 290 feet by 265 feet, with the main building approximately 265 feet by 220 feet, and the annex approximately 110 feet by 110 feet. The control building is surrounded by 8 hardened (subsurface) antennas, 16 short- and medium-distance fishbone receiving antennas including 1 probable fishbone antenna, and 2 horizontal dipole antennas. Antennas numbered 46 and 36 on Figure 9 are paired long-distance fishbone receiving antennas. Each of these antennas is approximately 900 feet long.

On [redacted] photography, no construction activity could be observed at the end of the access road serving this site. The site was next observed on [redacted] photography, at which time the actual control building can be identified in a mid-stage of construction. From subsequent photographic coverage, it may be inferred that the small annexes on Antenna Site 2 and Antenna Site 3 earth-mounded control buildings are of less importance than the earth-mounded control buildings, as the annexes are the last to be constructed and earth mounded. The annexes would appear to function in support of the larger earth-mounded control buildings.

Administration and Support Area. This area (Figures 8 and 9) contains at least 55 buildings of various sizes and functions. An athletics field is west of and outside of the security fence which surrounds the facility. A probable auxiliary powerplant and associated earth-mounded fuel storage facility is on the northern edge of the support area. This support area has increased in both size and activity as the construction of the earth-mounded control buildings progressed.

A construction chronology of this facility is included in Appendix B. This chronology is followed by maps showing the approximate azimuth projections of the principal HF antennas and antenna groups (Figure 33), the approximate azimuth projections of the hardened (subsurface) antennas (Figure 34), and Table 2 which contains the antenna azimuths, designations, types, and possible correspondents.

Ramenskoye Central Command Communications Facility (Receiving)

The Ramenskoye Central Command Communications Facility (Receiving) is at 55-31N 038-03E, approximately 20 nm south-southeast of Moskva (Figure 1). The facility (Figures 12, 13, and 14) is single fenced and contains a total of 26 HF antennas including 1 dipole, 12 fishbone, and 13 double rhombic antennas. A large L-shaped earth-mounded central control building, [redacted] is surrounded by 6 hardened (subsurface) antennas. Two lattice towers of unidentified function and 4 small support buildings are also near the control building. An Administration and Support Area is on the southeastern edge of the facility and contains 17 structures including a small heating and power plant, a probable operations building, a long vehicle-maintenance building, and a small earth-mounded building of undetermined function. The remaining 13 buildings appear to be logistical in function. The Administration and Support Area appears similar to those areas found at Soviet deployed MRBM and IRBM complexes.

At this time, the exact function of the Ramenskoye facility has not been determined. It is sufficiently similar to the Novopetroskoye and Naro-Fominsk facilities to be justifiably identified as a Central Command Communications Facility of some type. The presence of the hardened (subsurface) antennas and the extent of the hardening of the control area leads one to believe that the function of

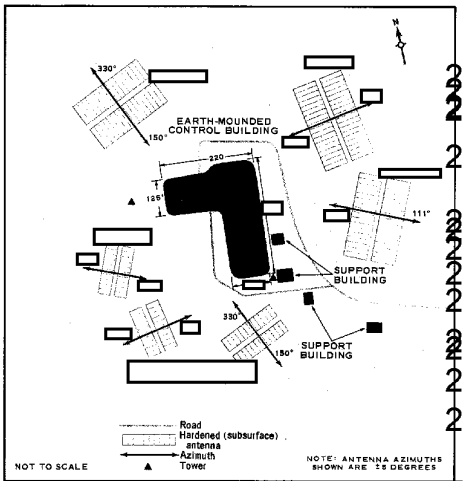

FIGURE 12. EARTH-MOUNDED CENTRAL CONTROL BUILDING, RAMENSKOYE.

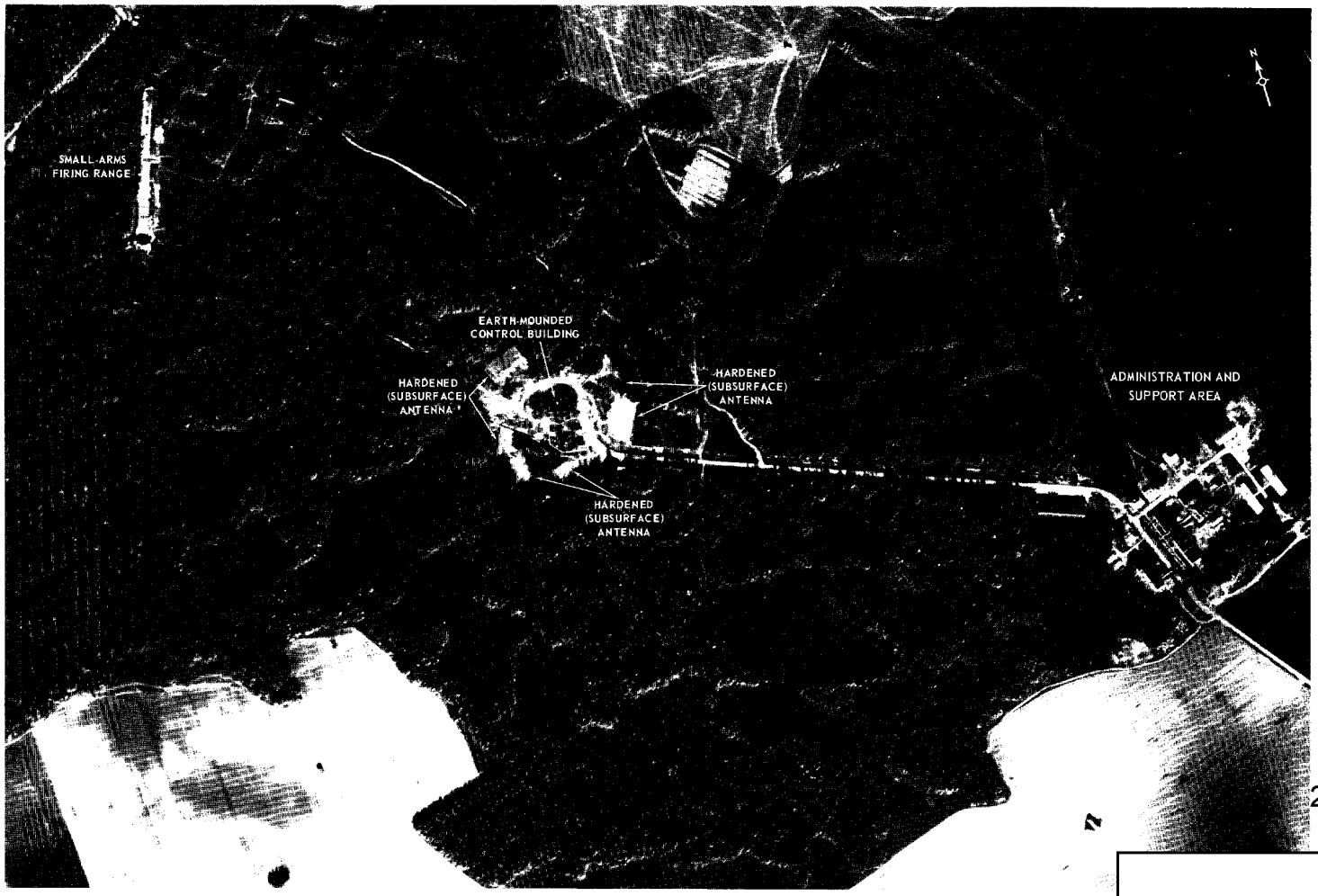

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FIGURE 13. RAMENSKOYE CENTRAL COMMAND COMMUNICATIONS FACILITY (RECEIVING).

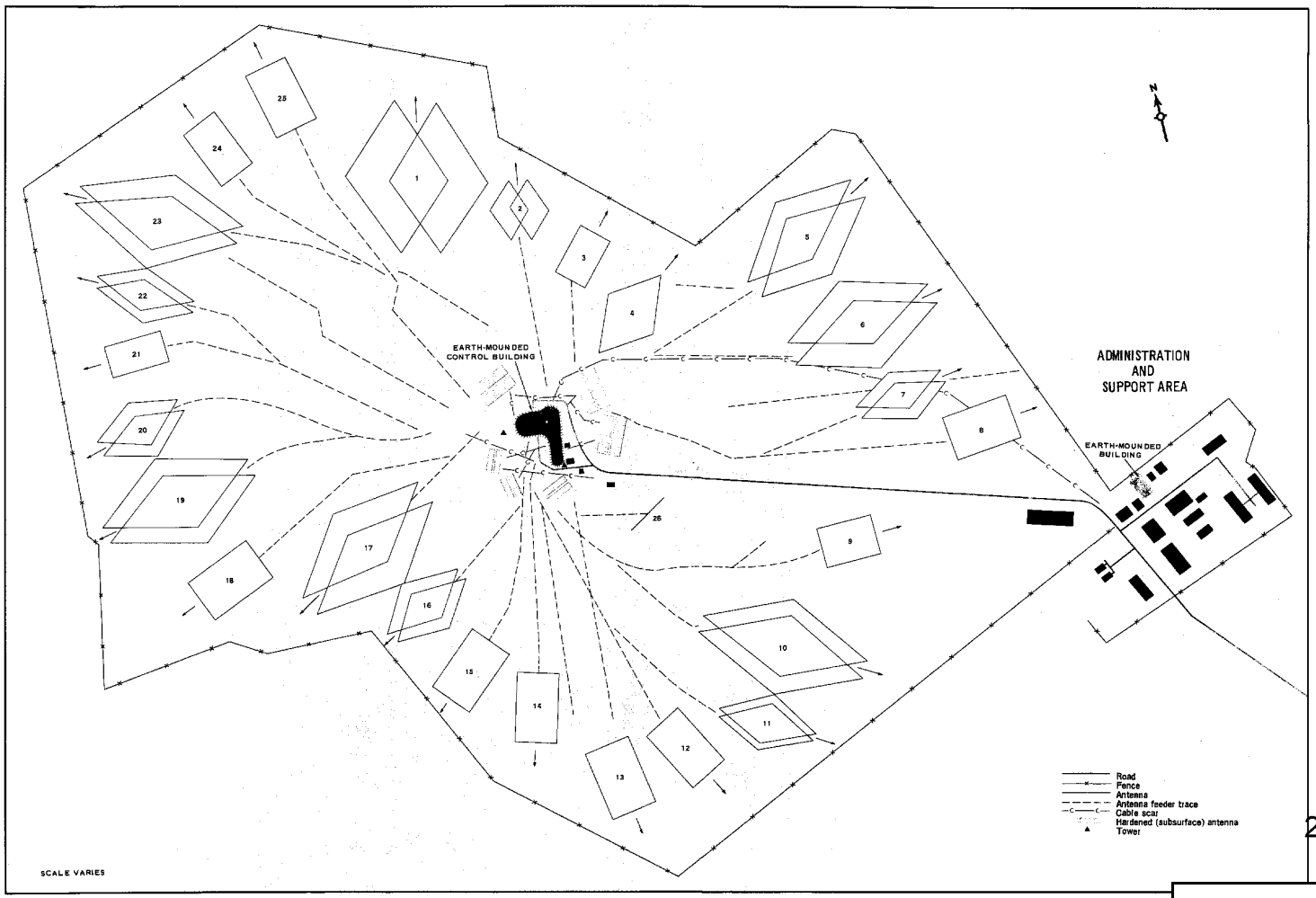

FIGURE 14. LAYOUT OF RAMENSKOYE CENTRAL COMMAND COMMUNICATIONS FACILITY (RECEIVING).

the Ramenskoye facility is within the higher levels of the Soviet command communications structure. In addition to the earth-mounded control building and hardened (subsurface) antennas, the azimuthal projections of aboveground antennas give reasonably good coverage of the prime areas of missile deployment. Precise correspondents, however, have not been determined.

A brief construction chronology of this facility is included in Appendix B. This chronology is followed by maps showing the approximate azimuthal projections of the principal HF antennas and antenna groups (Figure 35), the approximate azimuthal projections of the hardened (subsurface) antennas (Figure 36), and Table 3 which contains the antenna azimuths, designations, types, and possible correspondents.

CENTRAL COMMAND OPERATIONS OR HEADQUARTERS FACILITIES

Previous NPIC reports 1, 2, 3/ on SRF field communications facilities implied that the higher in the echelon of command, the more space required for the operations area of the communications facility. At the missile launch complexes, the lowest echelon analyzed, the communications operations were conducted in a hardened, earth-mounded control building at the center of the antenna field. At the SRF probable regional headquarters facilities, probably the division level, the communications operations required not only a larger earth-mounded control building than at the missile launch complexes, but also an added headquarters area. This headquarters area contains a triple-sectioned, earth-mounded building and adequate support buildings.

Every communications facility in the Moskva area was studied on all interpretable photography available. Each of the facilities was examined for similar earth-mounded buildings, support and headquarters areas. From this examination, both the Central Command Communications Facilities and the Central Command Operations or Headquarters Facilities were identified. The 4 Central Command Operations or Headquarters Facilities identified to date are near Perkhushkovo, Chernoye, Sharapovo, and Chekhov. All of these are considered to be central command facilities of some type, although not necessarily SRF Central Command Facilities. One of these, the Perkhushkovo facility, is favored in this report as the most likely candidate to be the Probable SRF Central Command Headquarters Facility because of the large size of the 2 earth-mounded personnel buildings and their immediate support buildings which were constructed during the same time as the facilities at the launch complexes, the regional headquarters facilities, and the new facilities at Novopetrovskoye and at Naro-Fominsk. The 3 other command centers predate the construction of the SRF HF back-up communications systems. In addition, the Perkhushkovo facility is favorably situated (Figure 1) approximately midway between Novopetrovskoye and Naro-Fominsk, and the Perkhushkovo earth-mounded control buildings are of the rectangular, low-profile type similar to the earth-mounded buildings within the Novopetrovskoye and Naro-Fominsk facilities.

Perkhushkovo Probable SRF Central Command Headquarters Facility

The most significant components of the Perkhushkovo facility (Figures 15 and 16) are the 4 semiburied, earth-mounded buildings within a separately secured area on the west side of the facility. Two of these buildings are each approximately 360 feet long and 135 feet wide, and after construction they appear as one large mound. The other 2 earth-mounded buildings are both separate and smaller.

On [redacted] photography, only a large clearing was in the woods in the area where the 2 large earth-mounded buildings were subsequently constructed. The construction of the facility was observed on [redacted] photography from [redacted] the large semiburied buildings were externally complete and the earth mounding of them was nearly complete. At the present time, these large buildings are so well concealed that only 2 large low-profile mounds are apparent in the woods.

This facility also contains approximatey 170 administration and logistical buildings and structures.

This installation has been identified in a DIA report 6/ as the Perkhushkovo Supreme Missile Headquarters for Soviet Rocket Troops.

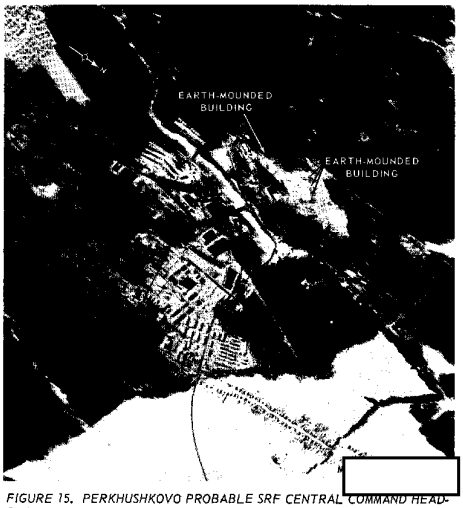

FIGURE 15. PERKHUSHKOVO PROBABLE SRF CENTRAL COMMAND HEADQUARTERS FACILITY.

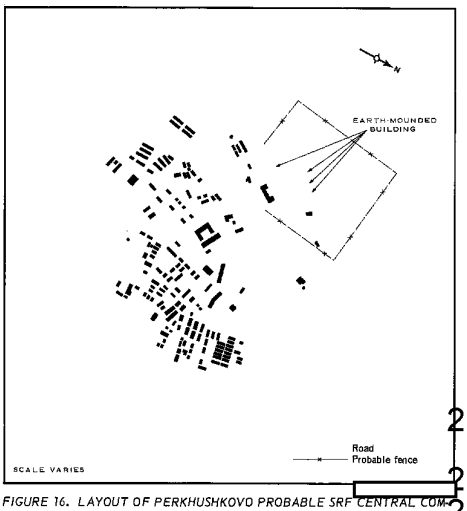

FIGURE 16. LAYOUT OF PERKHUSHKOVO PROBABLE SRF CENTRAL COMMAND HEADQUARTERS FACILITY.

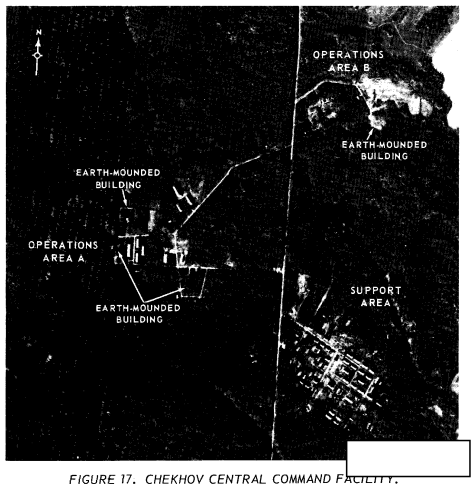

FIGURE 17. CHEKHOV CENTRAL COMMAND FACILITY.

Chekhov Central Command Facility

This facility (Figures 17 and 18) is in a heavily wooded area, is concealed from ground observation by trees, has 2 double-secured operations areas, and has a very large support area. This facility has previously been designated in a NPIC report 4/ as the [redacted]

The western operations area, designated Operations Area A, contains 3 circular earth-mounded personnel buildings, each approximately [redacted] in diameter. These buildings are supported by 9 adjacent barracks and 15 support buildings.

The eastern operations area, designated Operations Area B, contains 1 circular earth-mounded personnel building approximately 315 feet in diameter, and 5 adjacent barracks and several support buildings.

The Support Area contains approximately 80 structures including barracks, housing, administration, and utility buildings.

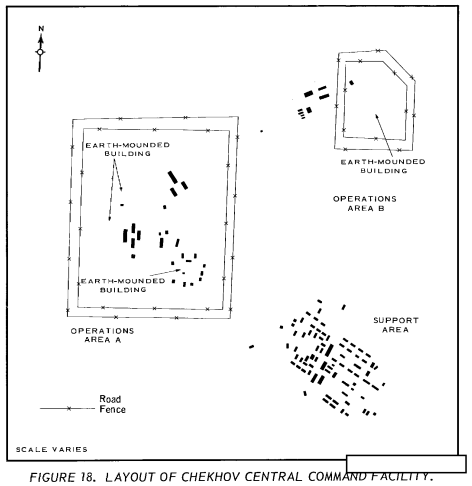

FIGURE 18. LAYOUT OF CHEKHOV CENTRAL COMMAND FACILITY.

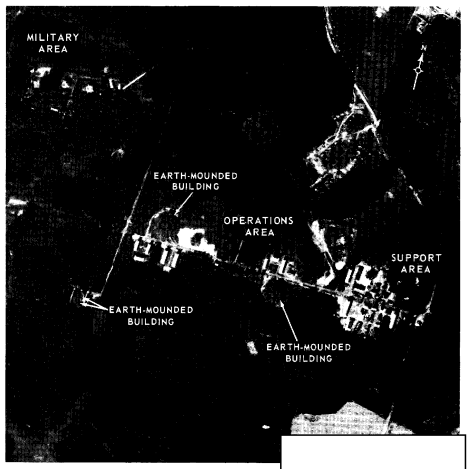

FIGURE 19. CHERNOYE CENTRAL COMMAND FACILITY.

Chernoye Central Command Facility

The Chernoye facility (Figures 19 and 20) is in a heavily wooded area, and is concealed from ground observation. In a CIA report, 7/ this facility was identified as a [redacted]

The Operations Area is fenced and contains 2 circular earth-mounded personnel buildings, each approximately 300 feet in diameter, and 2 smaller earth-mounded buildings of unidentified function. These earth-mounded personnel buildings are much larger than the earth-mounded personnel buildings at Chekhov. There are 5 large buildings adjacent to the western earth-mounded personnel building and 4 large buildings adjacent to the eastern earth-mounded personnel building. These 9 buildings include several crew-quarters barracks.

On the eastern side of the Operations Area is a Support Area containing approximately 24 barracks and utility buildings, and a heating and power plant. Just northwest of the Operations Area is a small associated military area containing a motor pool and a small-arms firing range.

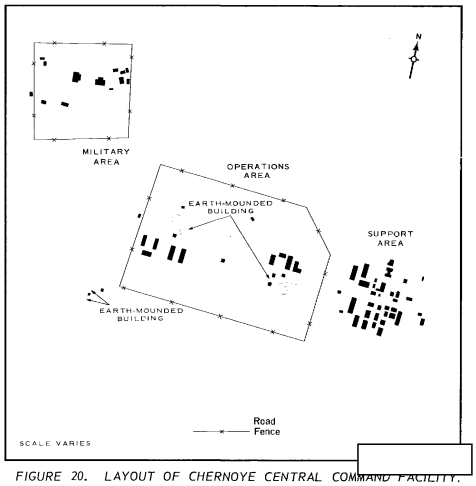

FIGURE 20. LAYOUT OF CHERNOYE CENTRAL COMMAND FACILITY.

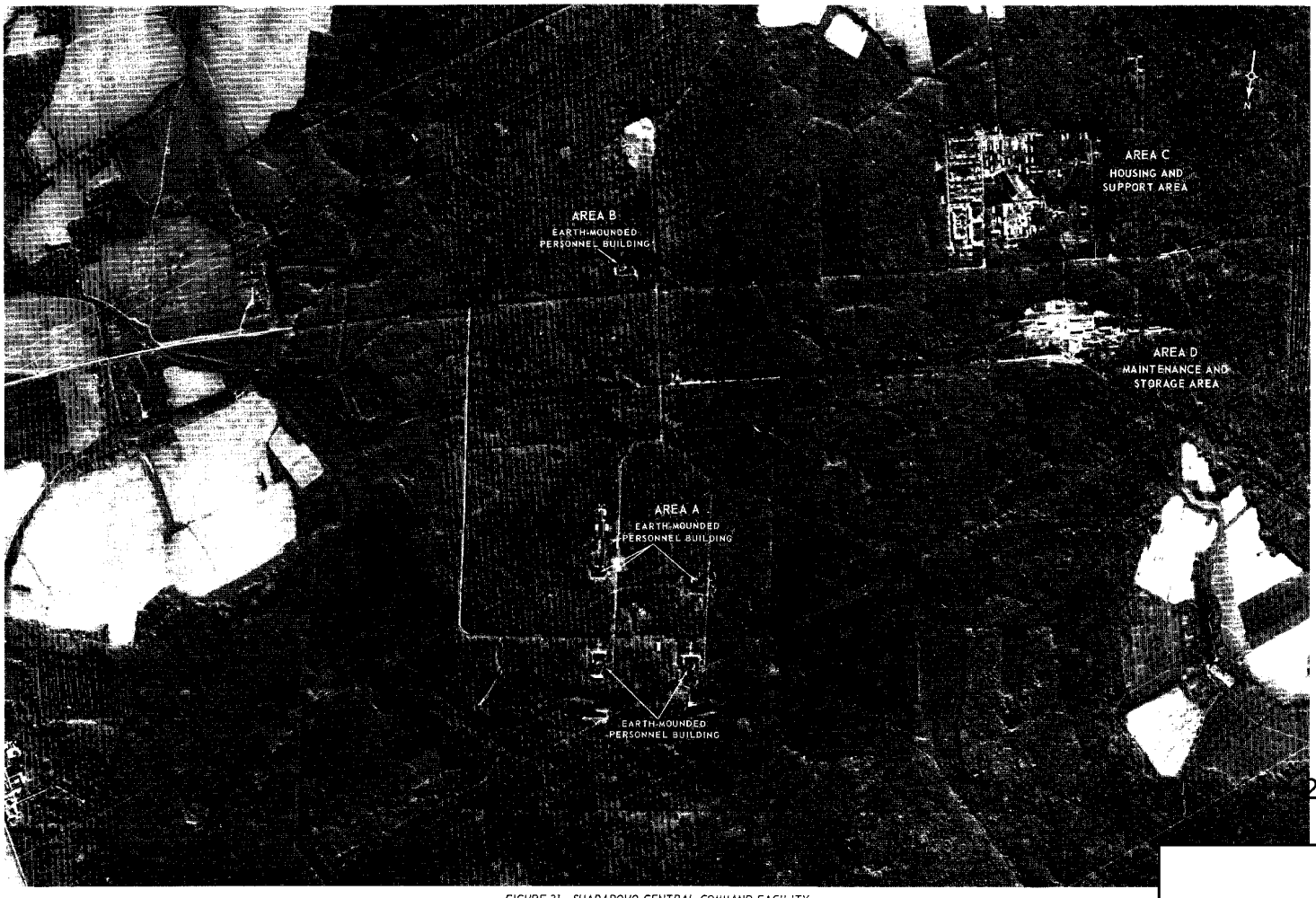

FIGURE 21. SHARAPOVO CENTRAL COMMAND FACILITY.

The reported function of the Chernoye facility 7/ that is, probable national air defense, has merit. Although not mentioned in the referenced report, the facility is connected by a road to a second support area containing approximately 85 structures of mixed functions including barracks, maintenance, administration, and logistic support buildings. This second support area previously has been determined to be associated with the Moskva/Chernoye Inner Ring Air Warning Facility.

Sharapovo Central Command Facility

This facility (Figures 21 and 22) is in a heavily wooded area, is partly concealed from ground observation, and is the largest of its type in the environs of Moskva. It is rail and road served, and contains 2 earth-mounded personnel building areas, a housing and support area, and a rail- and road-served maintenance and storage area.

The separately secured northern earth-mounded personnel building area, designated Area A, contains 5 earth-mounded personnel buildings and 24 on-site housing and support structures. The northern 2 earth-mounded personnel buildings are each 440 feet in diameter; the western earth-mounded personnel building is 400 feet in diameter; and the 2 eastern earth-mounded personnel buildings are each 225 feet in diameter.

The southern earth-mounded personnel building area, designated Area B, contains 1 separately fenced earth-mounded personnel building approximately 400 feet in diameter and a single on-site housing structure.

The housing and support area, designated Area C, contains approximately 155 structures including housing, storage, and utility buildings. In addition, there is a diesel electric plant within the area.

The maintenance and storage area, designated Area D, is both rail and road served, and contains approximately 15 buildings including 2 assembly-type buildings. The presence of this area with an adjacent rail spur indicates the augmented capability of the Sharapovo facility not at the Perkhushkovo, Chernoye, and Chekhov facilities.

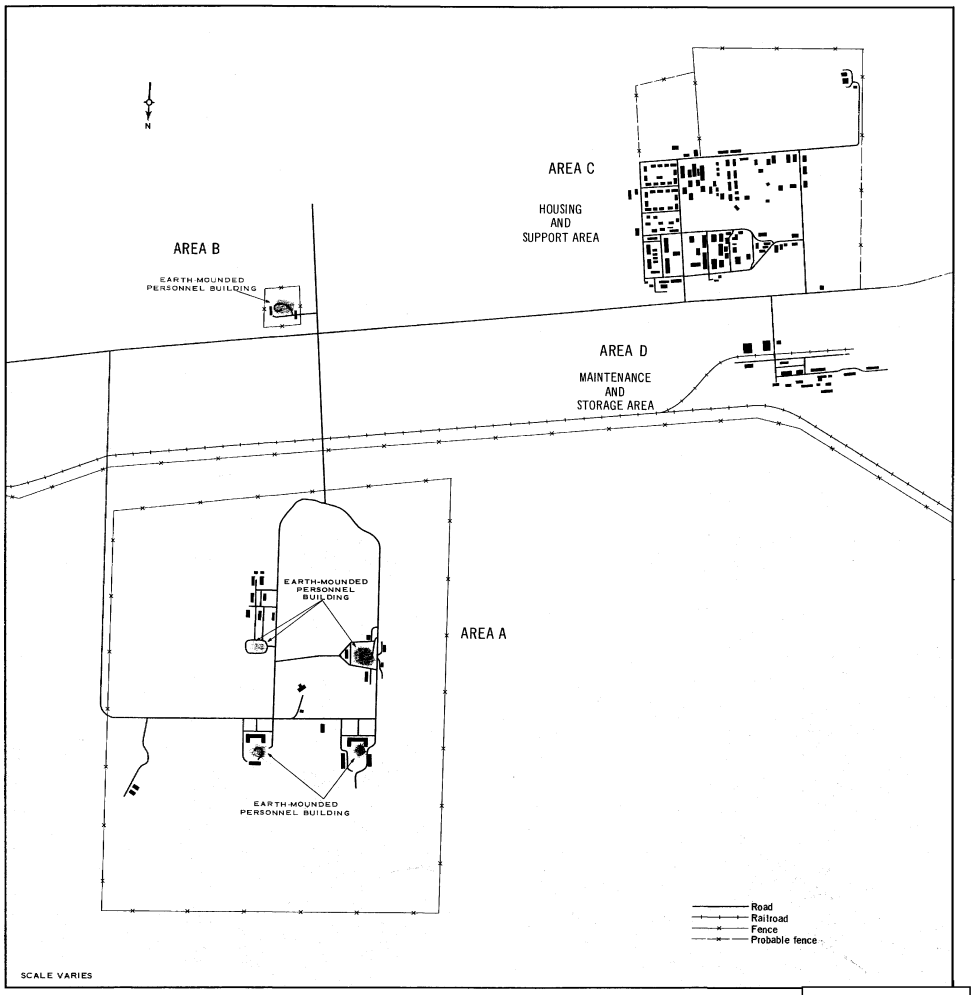

FIGURE 22. LAYOUT OF SHARAPOVO CENTRAL COMMAND CONTROL FACILITY.

SIGNIFICANT HF COMMUNICATIONS FACILITIES

Three communications facilities, each containing earth-mounded buildings surrounded by HF antennas, have been identified in the USSR. To date, none of these facilities contains hardened (subsurface) antennas. These are Kryukovo HF Communications Facility (Figure 23), Poselok HF Communications Facility (Figure 24), and Pushkino HF Communications Facility (Figure 25).

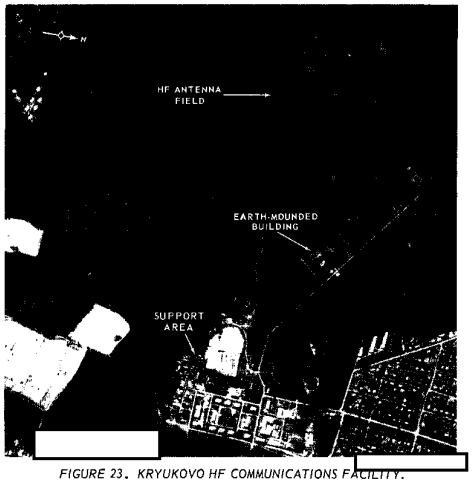

FIGURE 23. KRYUKOVO HF COMMUNICATIONS FACILITY.

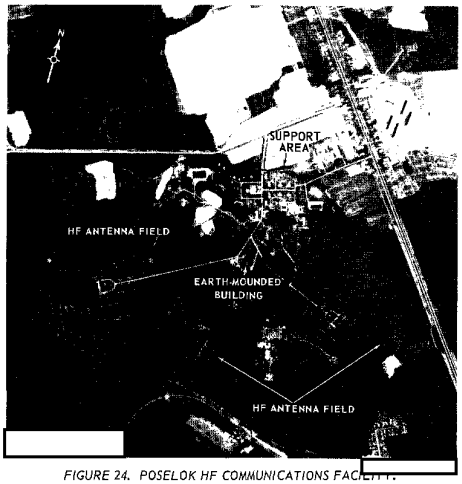

FIGURE 24. POSELOK HF COMMUNICATIONS FACILITY.

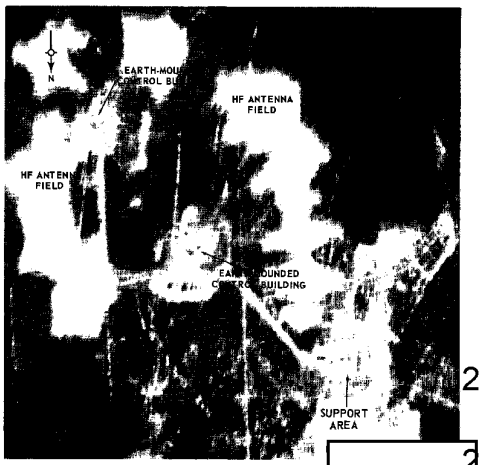

FIGURE 25. PUSHKINO HF COMMUNICATIONS FACILITY.

APPENDIX A
HARDENED ANTENNAS

The objective of this appendix is to present a general description of hardened (subsurface) antennas. The reader is also encouraged to read the referenced reports, 8, 9, 10, 11, 12, and 13/ on hardened antennas as these are probably the best available sources of background information on hardened antennas.

The hardened (subsurface) type of antenna is newly identified in the USSR in this report. This is the first known specific information published on actual deployment of them in the USSR. The presence of this type of antenna was one of the prime identification signatures in determining the association of the facilities described in this report with the SRF.

The use of hardened antennas, both in the US and the USSR, has been made possible as the result of rather recent technical achievements. Therefore, extensive research which would have delayed this report will be required before a full report on Soviet hardened (subsurface) antennas may be prepared.

SOVIET HARDENED (SUBSURFACE) ANTENNAS

Soviet hardened (subsurface) antennas (Figures 26 through 30) appear to be constructed of numerous dipole antennas, each approximately a quarter wavelength long, which are arranged linearly in parallel rows to form a rectangle. The entire antenna array appears to be buried to a depth of approximately [redacted] Based on the spacing and depth of the emplaced dipoles, the resonant frequency of the Soviet hardened (subsurface) antennas is inferred to be within the lower portions of the HF spectrum.

During early stages of construction, the general appearance of the hardened (subsurface) antenna is that of a buried fishbone antenna, but with the dipoles placed closer together. The dipoles of the entire antenna assembly are carefully buried in intersecting trenches which are then earth-mounded. Thus, the earth-mounded antenna array becomes a part of the earth. Soviet hardened (subsurface) antennas, therefore, are neither pop-up type nor are they stored in coffin-like cavities. It is also apparently important to keep the dipoles reasonably dry as the top of the grid is slightly above the normal level of the earth's surface and the antenna presents a low profile. The dipoles of the antenna are center fed as noted from the conspicuous trench which bisects the array. Transmission line attenuation is apparently critical because the antennas are always placed close to the earth-mounded control building.

An anomaly was observed with respect to this type of hardened (subsurface) antenna. As deployed by the Soviets, the antenna array apparently has some directivity as indicated by its alignment with respect to certain aboveground HF antennas. Most of the available engineering studies indicate that the array is omnidirectional and propagates a conventional Norton surface wave. If the Soviets have designed and deployed a directive hardened (subsurface) antenna, the antenna orientation may then point to other components of the SRF command structure. At this time, inspection of the antenna orientation and plotting preliminary azimuths indicate a much longer range than normally accredited to this type of antenna. Ranges of from 600 to 1,000 nm are anticipated.

The dimensions and orientations of the hardened (subsurface) antennas at the Novopetrovskoye facility are included in Figures 4 and 5, at the Naro-Fominsk facility are included in Figures 6 and 7, and at the Ramenskoye facility are included in Figure 12.

APPENDIX B
CONSTRUCTION CHRONOLOGY

Novopetrovskoye

The Novopetrovskoye facility was first identified on [redacted] photography. This coverage is hazy and of poor interpretability. Antenna Site 1, which may be active at this time, consists of a single large control building, 1 smaller building, and at least 5 and possibly 10 probable rhombic antenna scars and clearings. Antenna Site 2 contains a small clearing and a possible small building, but no antenna clearings or other construction are apparent. There is no evidence of any buildings or antenna clearings at Antenna Site 3, but there does appear to be a road leading to the clearing in which an earth-mounded control building will be built. The support area is in a very early stage of construction, is probably singly secured, and contains approximately 20 buildings.

[redacted] photography is the next coverage of the facility and is of fair interpretability. At Antenna Site 1, much track activity is apparent around the control building, and at least 5 secondary buildings, 2 probable cooling ponds, and scattered stacks of construction materials are identifiable. There is a long linear scar to the south of the control building which may be an attempt to bury an incoming powerline. At this stage of construction, Antenna Site 1 is surrounded by at least 30 antenna clearings. Antenna Site 2 is fenced on at least 1 side and an earth-mounded control building is under construction within an excavation. This antenna site is surrounded by at least 10 antenna clearings in varying degrees of completion. There is some construction evident at Antenna Site 3, probably work on the excavation. This antenna site contains 1 small building and at least 1 section of the fence which surrounds the site during construction. There are also at least 2 antenna clearings associated with this site. The clearing which is probably used to pile the spoil from the excavation is apparently free of spoil, indicating the excavation work probably had not yet begun. However, there does appear to be a rounded, L-shaped mound or revetment at the point where the excavation will be dug. The Administration and Support Area contains as least 30 buildings, and the road to what will be the probable auxiliary powerplant is apparently being used more than on the previous photographic coverage.

The next coverage of the facility is on [redacted] photography, but interpretation is limited. At least 2 secondary buildings have been completed at Antenna Site 1, and the site is now surrounded by approximately 25 antenna clearings. The excavation has been completed at Antenna Site 3 and the control building is under construction in the excavation. The construction area at this site appears to be singly secured, and contains at least 1 rectangular secondary building. The site is surrounded by approximately 25 antenna clearings at this stage of construction. The Administration and Support Area now contains a minimum of 50 buildings and is at least partially secured. The small construction area east of the Administration and Support Area contains 3 probable small buildings, and construction is apparently continuing.

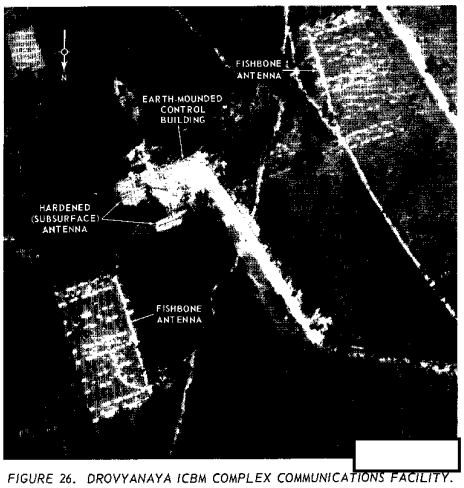

FIGURE 26. DROVYANAYA ICBM COMPLEX COMMUNICATIONS FACILITY.

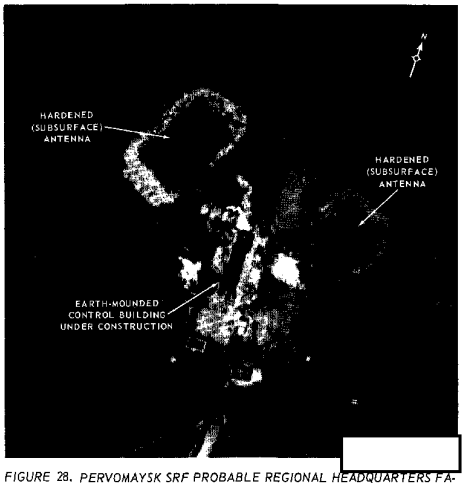

FIGURE 28. PERVOMAYSK SRF PROBABLE REGIONAL HEADQUARTERS FACILITY.

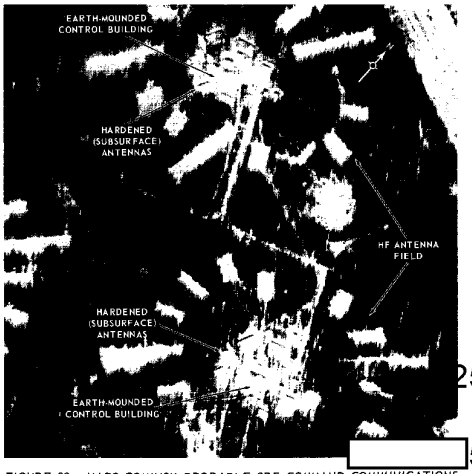

FIGURE 29. NARO-FOMINSK PROBABLE SRF COMMAND COMMUNICATIONS FACILITY (RECEIVING), ANTENNA SITES 2 AND 3.

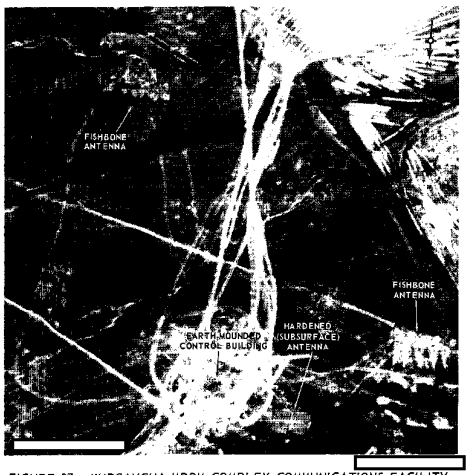

FIGURE 27. KURGANCHA MRBM COMPLEX COMMUNICATIONS FACILITY.

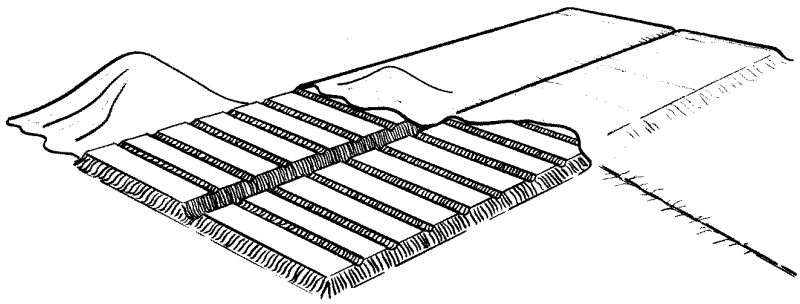

FIGURE 30. PERSPECTIVE VIEW OF A SOVIET HARDENED (SUBSURFACE) ANTENNA UNDER CONSTRUCTION.

photography was of very good interpretability, but unfortunately part of the facility is cloud covered. photography does not have the same high quality of interpretability, but the facility is cloud free. Antenna Site 1 contains a large central control building, 6 medium-sized rectangular buildings, 1 T-shaped building, 1 small square building partly enclosed by a fence, 2 circular probable cooling ponds, and several storage sheds and piles of construction materials. The control building is surrounded by approximately 45 antennas in various stages of construction. At Antenna Site 2, the control building is still under construction in the excavation and a new structure has been built within the construction fence at the southeast end of the excavation. This structure may now be complete. It was visible on photography, but then appeared to be incomplete. The main control building, before being earth mounded, is approximately 160 feet by 115 feet and the new adjacent structure is approximately 115 by 60 feet. On one side of the site, the fence merges with a pair of small rectangular buildings, and there is another building outside the fence. The site is surrounded by approximately 30 antenna clearings. Antenna Site 3 is surrounded by a construction fence, and the central control building is apparently still under construction. Two circular objects are on the southwest side of the control building. They appear somewhat like cooling ponds, but they are subsequently covered although not earth mounded. The construction area also contains 2 small buildings, several sheds or piles of construction materials, and, outside the gate, 1 or 2 small buildings. A new structure is at the northeast end of the excavation. It is apparently similar to and was first apparent at the same time as the new structure at Antenna Site 2. The main control building, before being earth mounded, is approximately 115 by 110 feet and the new structure is approximately 115 by 70 feet. The new structures at both Antenna Sites 2 and 3 do not appear to protrude above ground level. Antenna Site 3 is surrounded by approximately 30 antenna clearings. There does not appear to be any change in the Administration and Support Area, but the small construction area just to the east now contains a possible generator building and 2 possible earth-mounded fuel storage tanks.

photography is hazy, but there seems to be very little change since The control building at Antenna Site 3 appears to be nearly complete, although they apparently have not begun to earth mound it.

photography is clear, oblique coverage. There is no apparent change in Antenna Site 1. Antenna Site 2 control building is apparently in a late stage of earth mounding. The main construction work at Antenna Site 3 seems to be complete, but apparently the earth mounding of the control building has not yet been started. The new structure at the end of the control building now appears to be approximately the height of the control building. It also has several unidentified objects on the roof which appear to be similar to those on the roof of the control building and which are visible after earth mounding.

The coverage of photography is limited by snow and scattered clouds, but the resolution is good. There has been little change in Antenna Site 1. Construction in this area is probably complete because the extra construction shacks and piles of materials appear to have been removed. Antenna Site 2 control building is still in a late stage of earth mounding, although partial cloud cover precludes a precise determination of its status; approximately 17 antenna clearings are visible. Antenna Site 3 is cloud covered, and consequently cannot be viewed. Antenna Site 1 is surrounded by approximately 40 antenna clearings. Antenna Site 3 includes at least 30 antenna clearings. No changes were observed in the Administration and Support Area.

photography is good, but difficult to interprete because of the road patterns and irregular snow melting. At Antenna Site 1, one of the rectangular buildings in the group at the west end of the main control building has been removed, leaving at the west end 2 medium rectangular, 1 T-shaped, and 1 small rectangular buildings. In the same area, they appear to be adding more antennas, probably 2 groups of double day/night rhombics, or 8 new antennas in all. Nothing new can be determined about Antenna Site 2. Antenna Site 3 appears to be nearly complete, but the earth-mounded control building is clear of snow. At this time, evidence of construction of at least 2 hardened (subsurface) antennas was first observed. No changes are observed in the Administration and Support Area.

photography indicates that they probably have removed 2 more buildings from the west end of the control building at Antenna Site 1, which leaves 1 T-shaped and 1 medium-sized rectangular buildings. Antenna Site 2 control building is still in a late stage of earth mounding. The auxilliary structure at 1 end of the control building appears to be about one-half the height of the main building, and apparently has not been earth mounded. At Antenna Site 3, the earth mounding may be complete, but there is still so much earth scarring in the earth-mounded area that it is difficult to determine.

photography shows very little change in the overall facility. Antenna Site 1 is partially cloud covered and no changes are visible. The earth mounding was definitely complete at Antenna Site 2, but no other changes are apparent in this area. The earth-mounding at Antenna Site 3 is probably complete, but the construction fence is in place, and construction debris has not been removed.

photography, the facility appears to be basically complete other than the hardened (subsurface) antennas still under construction.

Naro-Fominsk

The Naro-Fominsk Facility was first identified on photography which was of poor interpretability. Antenna Site 1 appeared to be operational at that time. The 2 access roads to Antenna Sites 2 and 3 can be observed. Earth scarring in the area of the future earth-mounded control building at Antenna Site 3 indicates the building may be in an early stage of construction. The central control building at Antenna Site 1 is surrounded by at least 10 forest clearings for fishbone antennas. A clearing in the forest for an unidentified inclined structure is also visible. The number of buildings in the Administration and Support Area is undeterminable on this photography.

On photography, the facility is partially obscured by scattered clouds, and the interpretation is limited. No forest clearings for the fishbone antennas can be observed at Antenna Site 3. A clearing

in the forest has been started for the future construction of the earth-mounded control building. Antenna Site 2 is partially cloud covered, but several clearings in the forest for the fishbone antennas are evident. There are no apparent changes in Antenna Site 1. The number of buildings in the Administration and Support Area is undeterminable on this photography.

On [redacted] photography, the forest clearings for the fishbone antennas, the dipole antennas, and the associated feeder lines to the antennas are fairly well defined at all 3 antenna sites. A large excavation for the earth-mounded control building is apparent at Antenna Site 3. At Antenna Site 2, earth scarring indicates the control building may possibly be in an early stage of construction. There is no apparent change in Antenna Site 1. Since the clearings for the feeder lines can be observed at Antenna Sites 2 and 3, it is assumed that the fishbone and dipole antennas have been erected and that the antennas were operational at the time of this photography. The Administration and Support Area contains at least 20 buildings.

On [redacted] photography, the construction activity is continuing at both of the earth-mounded control building sites and an inner security fence is around each site. The stage of completion of the earth-mounded control buildings cannot be determined on this photography. At least 3 forest clearings for hardened (subsurface) antennas around the earth-mounded building at Antenna Site 2 are now apparent. No changes can be observed in the antenna clearings or in Antenna Site 1. Snow precludes further interpretation of this photography.

On [redacted] photography, the earth-mounded building at Antenna Site 2 appeared to be in a mid stage of construction. At Antenna Site 3, earth backfilling of the earth-mounded control building and an excavation for an annex are apparent. The earth mounding of the control building can be observed. Two small support and security buildings are now on the access roads to the earth-mounded building sites. The Administration and Support Area has been expanded to approximately 40 buildings. A majority of the additional buildings appear to be large institutional-type or barracks-type structures. A probable auxiliary powerplant is on the northern side of the area. In addition to the control building, a support building and several other smaller buildings can be observed at Antenna Site 1.

On [redacted] photography, the backfilling of the control building at Antenna Site 3 was up to the level of the roof and a possible small crane was on the roof. One of the lower floors had been constructed in the annex to the earth-mounded control building at Antenna Site 3. No construction activity can be observed on the annex to the earth-mounded control building at Antenna Site 2. The number of cleared areas for hardened (subsurface) antennas had been increased from at least 3 to 5 at Antenna Site 2, and at least 3 new clearings for these antennas can be seen at Antenna Site 2. One of the clearings at Antenna Site 2 appeared to have had some aggregate dumped on it to form a flat rectangular mound approximately 10 feet high.

On [redacted] photography, the control building at Antenna Site 3 was approximately 85 percent earth covered and the annex to the earth-mounded control building appeared to be complete. Five rectangular, hardened (subsurface) antennas were located around the earth-mounded building at Antenna Site 3. Six rectangular hardened (subsurface) antennas were located at Antenna Site 2. The excavation for the annex to the earth-mounded control building at Antenna Site 2 is also apparent. Earth mounding of the control buildings was incomplete.

On [redacted] photography, the earth-mounded control buildings were in a late stage of being earth mounded with the roof outline and portions of the building still visible. The annex at Antenna Site 3 is now roofed and the annex at Antenna Site 2 is still under construction. There were no changes in the number of hardened (subsurface) antennas which surround the earth-mounded control buildings or the number of HF antennas at the central control building of Antenna Site 1.

[redacted] photography is limited by poor interpretability and obliquity, but there are indications that the earth mounding of the control buildings is probably complete.

There were no apparent changes in the earth-mounded control buildings observed on [redacted] photography, but a second security fence was evident around each earth-mounded control building. These fences enclose both the earth-mounded control buildings and the hardened (subsurface) antennas at each antenna site. Snow limits further interpretation.

On [redacted] photography, both of the earth-mounded control buildings and their additions were completely earth mounded. The hardened (subsurface) antennas that can be observed have a complete appearance with smooth tops, and a loop road serves the earth-mounded control building at Antenna Site 2.

On [redacted] photography, both antenna sites had approximately the same appearance as on [redacted] photography. However, a hard-surface loop road can be observed along the north side of the earth-mounded control building. A total of 8 hardened (subsurface) antennas are at Antenna Site 2 and 8 hardened (subsurface) antennas are at Antenna Site 3. Mensuration performed on the antennas is approximate because of the limiting conditions of the photography. There has been little or no change in Antenna Site 1 since it was first observed on [redacted] photography. The Administration and Support Area contains approximately 55 buildings. Little or no significant change has been observed since [redacted]

Ramenskoye

The Ramenskoye facility can be identified on Mission [redacted] photography. At that time, the Administration and Support Area contained approximately 7 buildings and a road could be observed from the Administration and Support Area to the area where the antenna field was subsequently constructed, although no activity could be observed at that end of the road. [redacted] photography shows a control building, but earth mounding of this structure is undetermined. There are indications that the antenna field is complete. By [redacted] photography, portions of the control building appear to be earth mounded. Subsequent photographic coverage indicates completion of the earth mounding and a slight increase in the number of buildings within the Administration and Support Area. The original number of antennas has remained constant since [redacted] photography.

Table 1. Novopetrovskoye SRF Central Command Communications Facility (Transmitting)

Antenna Azimuth (in degrees) ±5 degrees	Antenna Number (Keyed to Figure 3)	Antenna Type	Possible Correspondents
10	68	Rhombic	Arkhangelsk
	69	Rhombic	
	88	Vee	Plesetsk
	70	Rhombic	Ugolnyy
	71	Rhombic	
	26	Rhombic	Petropavlovsk
	27	Rhombic	Undetermined
	103	Rhombic	Undetermined
	102	Rhombic	Khabarovsk
	104	Rhombic	Svobodnyy
	105	Rhombic	
	29	Rhombic	Kostroma, Yurya, Vladivostok
	76	Probable Rhombic	
	106	Rhombic	
	28	Rhombic	Drovyanaya, Chita, Olovyannaya
	31	Rhombic	Gladkaya, Irkutsk, Ulan-Ude
	32	Dipole	
	33	Rhombic	
	34	Rhombic	
	35	Rhombic	
	72	Rhombic	
	73	Rhombic	
	77	Rhombic	
	78	Rhombic	
	108	Rhombic	
	101	Rhombic	Itatka, Uzhur
	109	Rhombic	
	110	Rhombic	
	22	Rhombic	Perm, Verkhnaya Salda,
	23	Rhombic	Novosibirsk
	24	Rhombic	
	25	Rhombic	
	30	Rhombic	
	36	Rhombic	
	37	Rhombic	
	38	Rhombic	
	107	Rhombic	
	40	Rhombic	Shadrinsk, Tyumen, Omsk
	41	Rhombic	
	39	Rhombic	Omsk, Aleysk
	79	Rhombic	
	80	Probable Rhombic	
	111	Rhombic	
	112	Rhombic	

Antenna Azimuth (in degrees) ±5 degrees	Antenna Number (Keyed to Figure 9)	Antenna Type	Possible Correspondents
80	84	Rhombic	Yoshkar-Ola, Zhangiz-Tobe
	85	Rhombic	
	74	Rhombic	Undetermined
	86	Rhombic	Kartaly, Imeni Gastello
	87	Rhombic	
	51	Rhombic	Dombarovskiy
	52	Rhombic	
	113	Rhombic	Aktyubinsk
	114	Rhombic	
	97	Vee	Baku Area
	115	Rhombic	
	116	Rhombic	
	42	Rhombic	Ordzhonikidze, Tibilisi
	43	Rhombic	
	117	Dipole	Undetermined
	81	Rhombic	Maykop
	82	Rhombic	
	44	Rhombic	Akhtyrka, Simferopol
	45	Rhombic	
	118	Rhombic	
	119	Rhombic	
	47	Rhombic	Kozelsk, Pervomaysk, Odessa
	120	Rhombic	
	121	Dipole	
	48	Dipole	Uman
	49	Rhombic	Zhmerinka
	50	Dipole	
	57	Dipole	
	9	Rhombic	Kiyev
	122	Rhombic	
	123	Dipole	
	10	Rhombic	Vinnitsa
	11	Rhombic	
	12	Rhombic	
	13	Rhombic	
	58	Dipole	
	61	Rhombic	
	62	Rhombic	
	89	Rhombic	
	90	Rhombic	
	55	Rhombic	Lvov
	56	Rhombic	
	124	Rhombic	
	125	Dipole	

Antenna Azimuth (in degrees) ±5 degrees	Antenna Number (Keyed to Figure 3)	Antenna Type	Possible Correspondents
	53	Rhombic	Lutsk
	54	Rhombic	
	91	Rhombic	
	92	Rhombic	
	75	Vee	Undetermined
	14	Rhombic	Undetermined
	59	Dipole	
	15	Rhombic	Smolensk
	95	Rhombic	
	96	Dipole	
	93	Rhombic	Minsk
	94	Dipole	
	60	Dipole	Vilnius
	1	Probable Rhombic	Kaliningrad Area
	2	Probable Rhombic	
	3	Probable Rhombic	
	4	Probable Rhombic	
	16	Rhombic	
	63	Rhombic	
	64	Rhombic	
	18	Rhombic	Riga
	19	Rhombic	
	5	Probable Rhombic	Ostrov Area
	6	Probable Rhombic	
	7	Probable Rhombic	
	8	Probable Rhombic	
	17	Rhombic	Ostrov, Voru, Torva
	65	Rhombic	
	83	Vee	
	66	Dipole	Undetermined
	98	Rhombic	
	99	Dipole	
	67	Dipole	Yedrovo, Leningrad Area
	46	Vee	Undetermined
	100	Probable Rhombic	Undetermined
	20	Rhombic	Belomorsk, Taybola
	21	Rhombic	

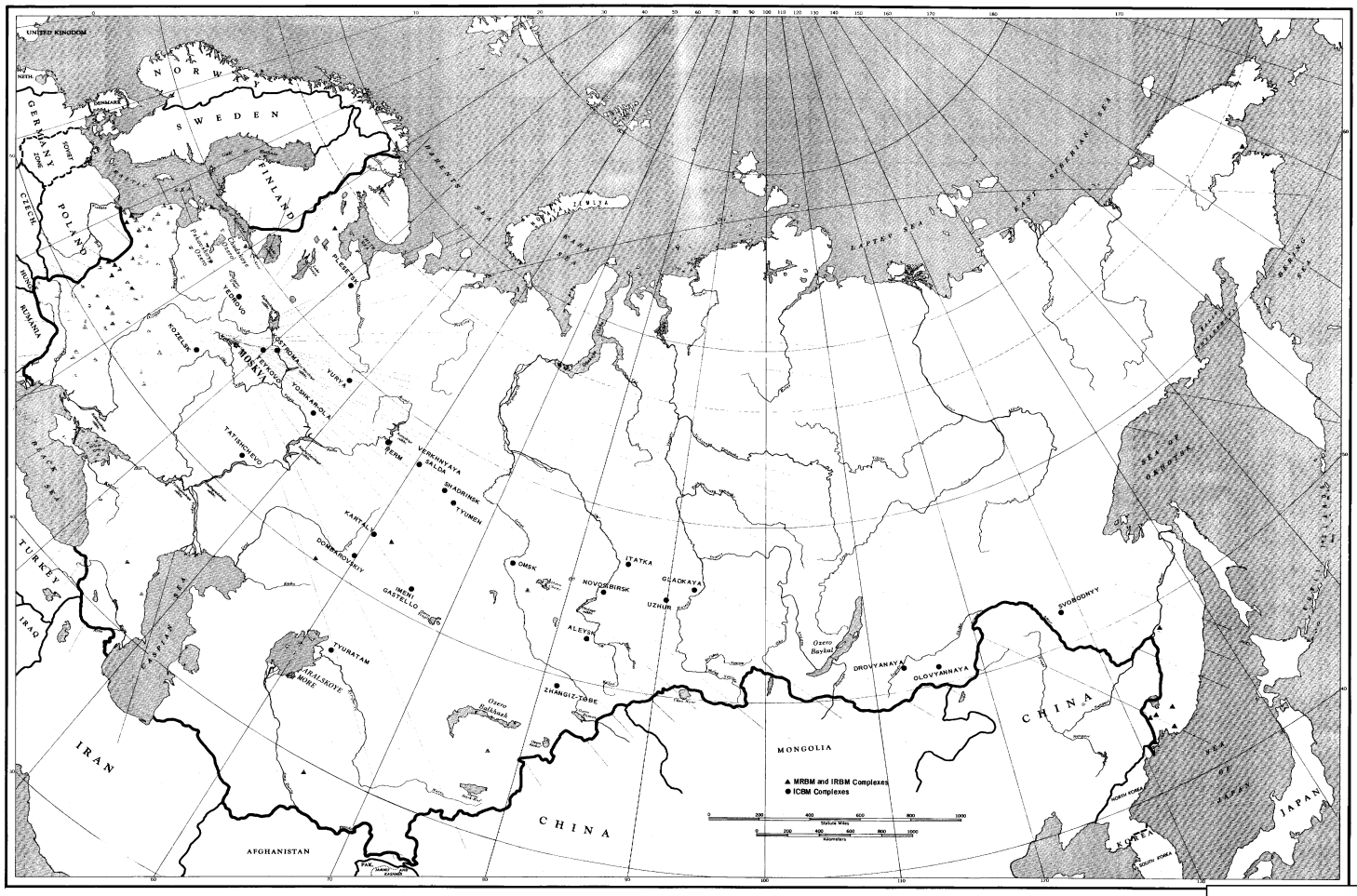

FIGURE 31. APPROXIMATE AZIMUTH PROJECTIONS OF PRINCIPAL HF ANTENNAS AND ANTENNA GROUPS AT NOVOPETROVSKOYE.

FIGURE 32. APPROXIMATE AZIMUTH PROJECTIONS OF HARDENED (SUBSURFACE) ANTENNAS AT NOVOPETROVSKOYE.

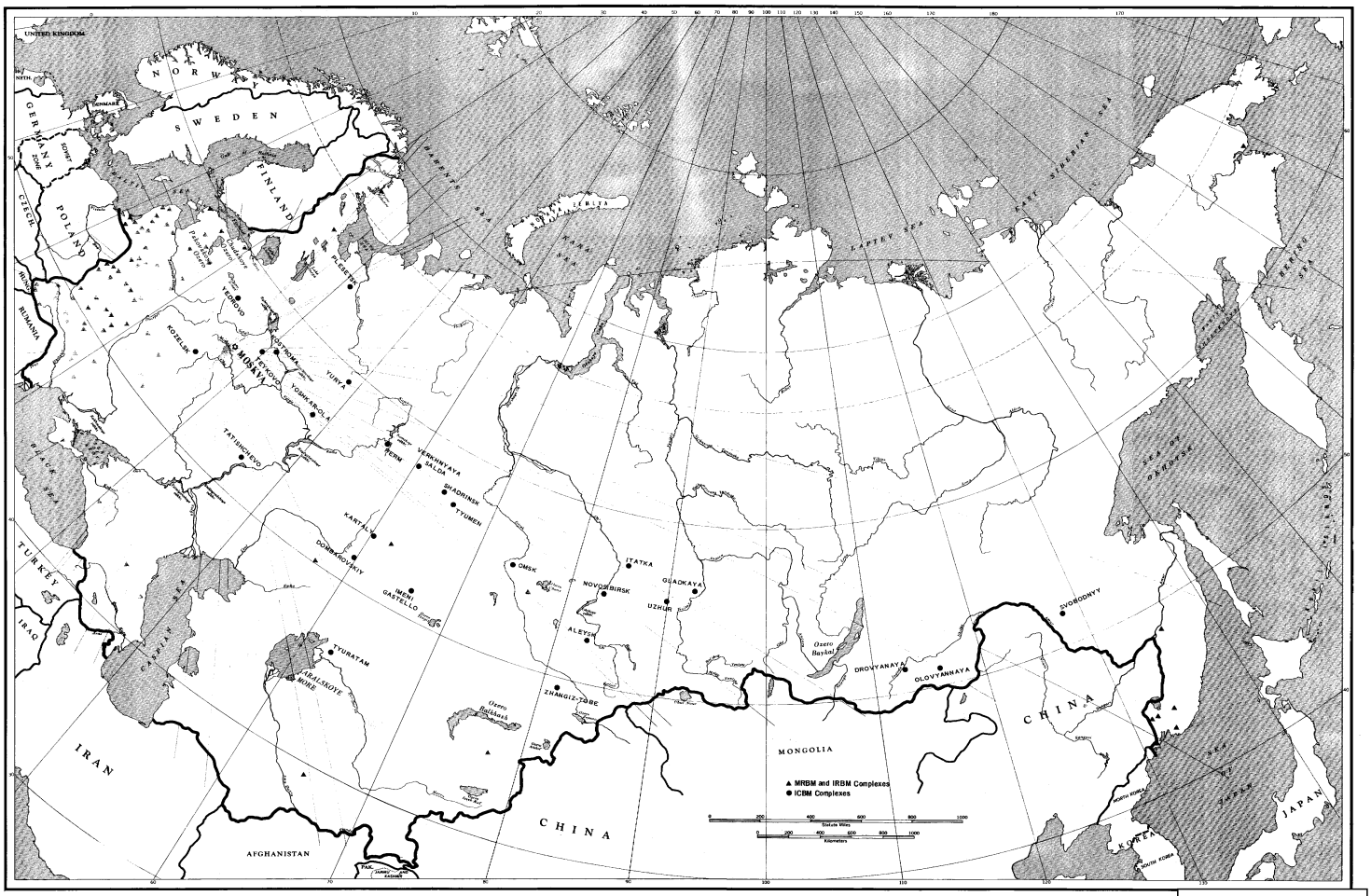

FIGURE 33. APPROXIMATE AZIMUTH PROJECTIONS OF PRINCIPAL HF ANTENNAS AND ANTENNA GROUPS AT NARO-FOMINSK.

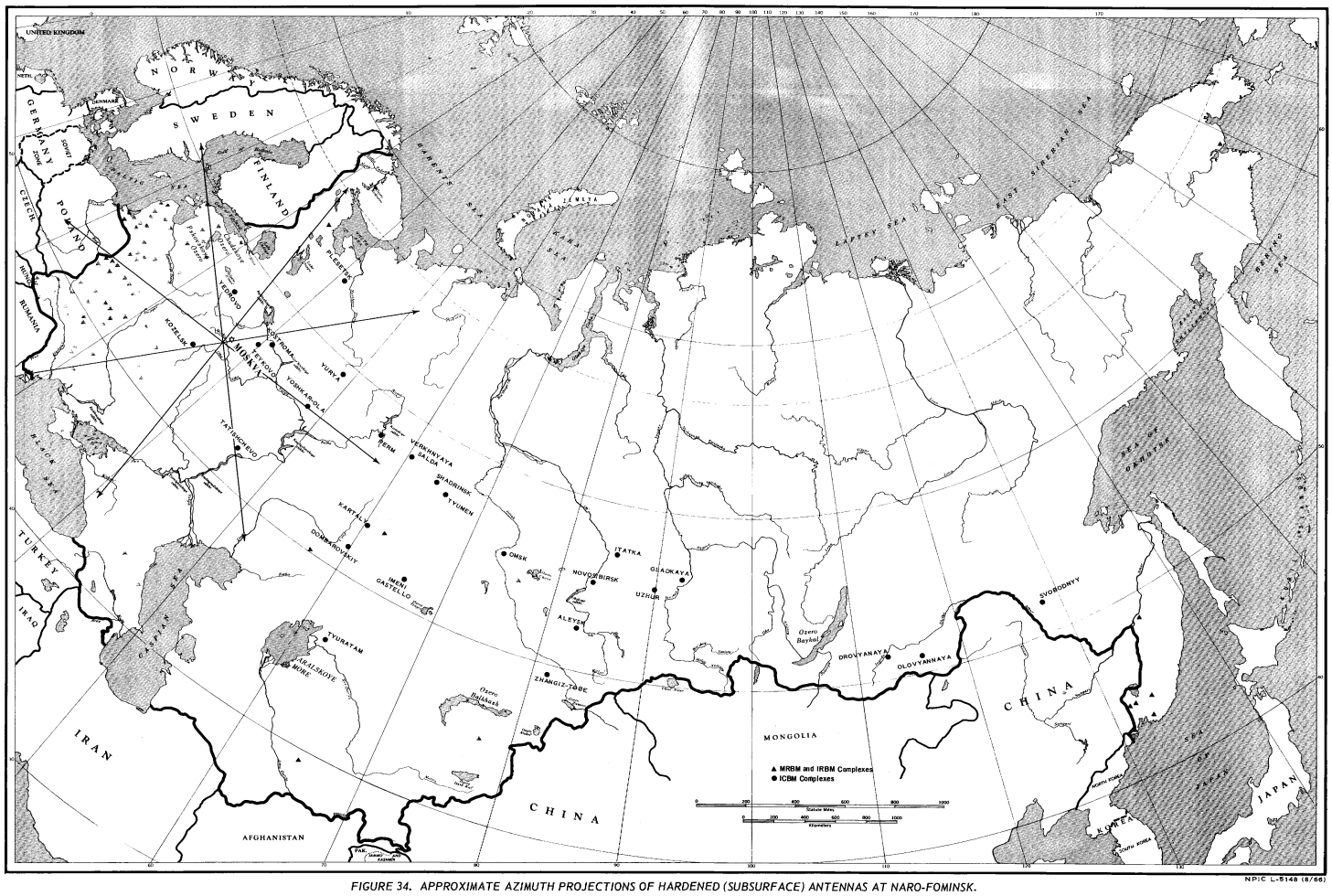

FIGURE 34. APPROXIMATE AZIMUTH PROJECTIONS OF HARDENED (SUBSURFACE) ANTENNAS AT NARO-FOMINSK.

Table 2. Naro-Fominsk Central Command SRF Communications Facility (Receiving)

Antenna Azimuth (in degrees)	Antenna Number (Keyed to Figure 9)	Antenna Azimuth (in degrees)	Antenna Number* (Keyed to Figure 9)	Antenna Type	Possible Correspondents
[redacted]	7			Probable Dipole	Undetermined
	41	[redacted]		Fishbone	Plesetsk, Arkhangelsk
	22			Fishbone	Plesetsk, Arkhangelsk
	23			Fishbone	Amderma, Kamchatka Area
	8			Probable Dipole	Undetermined
	25			Dipole	Teykovo, Kostroma
	9			Fishbone	Teykovo, Kostroma
	24			Fishbone	Komsomolsk
	10			Fishbone	Vladivostok
	42			Fishbone	Lutsk
	43			Fishbone	Drovyanaya, Olovyannaya
	11			Fishbone	Itatka, Gladkaya
	26			Fishbone	Perm, Novosibirsk
	46			Dipole	Yoshkar-Ola
	12			Fishbone	Aleysk
	44			Fishbone	Shadrinsk, Tyumen
	45			Fishbone	Slonim, Minsk
	47			Fishbone	Siauliai
	28			Dipole	Aktyubinsk
	27			Fishbone	Valga or Tyuratam
	13			Fishbone	Penza, Kurgancha
	14			Dipole	Tatishchevo Area
	48			Fishbone	Undetermined
	49			Fishbone	Leningrad or Kapustin Yar
	50			Fishbone	Ordzhonikidze
	29			Dipole	Undetermined
	15			Dipole	Undetermined
	51			Possible Fishbone	Undetermined
	30			Fishbone	Belomorsk, Taybola
	16			Fishbone	Simferopol
	33			Fishbone	Kozelsk, Kiyev
	1			Dipole	Minsk, Slonim
	2			Dipole	Riga Area
	3			Fishbone	Undetermined
	19			Fishbone	Riga Area
	4			Fishbone	Tallinn
	40			Dipole	Undetermined
	5			Fishbone	Undetermined
	6			Fishbone	Belomorsk

*Probable paired antennas.

Table 3. Ramenskoye HF Communications Facility

Antenna Azimuth (in degrees)	Antenna Number (Keyed to Figure 14)	Antenna Type	Possible Correspondents
	1 & 2	Day/Night Rhombic	Arkhangelsk
	4, 5 & 16, 17	Day/Night Rhombic	Yurya
	6, 7 & 19, 20	Day/Night Rhombic	Tyumen
	8	Fishbone	Undetermined
	9 & 21	Fishbone	Aleysk Area or Smolensk, Minsk
	10, 11 & 22, 23	Day/Night Rhombic	Tyuratam or Riga
	26	Dipole	Tambov Area
	13 & 25	Fishbone	Belomorsk Area or Batumi Area
	14	Fishbone	Simferopol Area
	15 & 3	Fishbone	Kozelsk
	18	Fishbone	Lutsk
	24 & 12	Fishbone	Yedrovo/Leningrad

*Poor mensural data.

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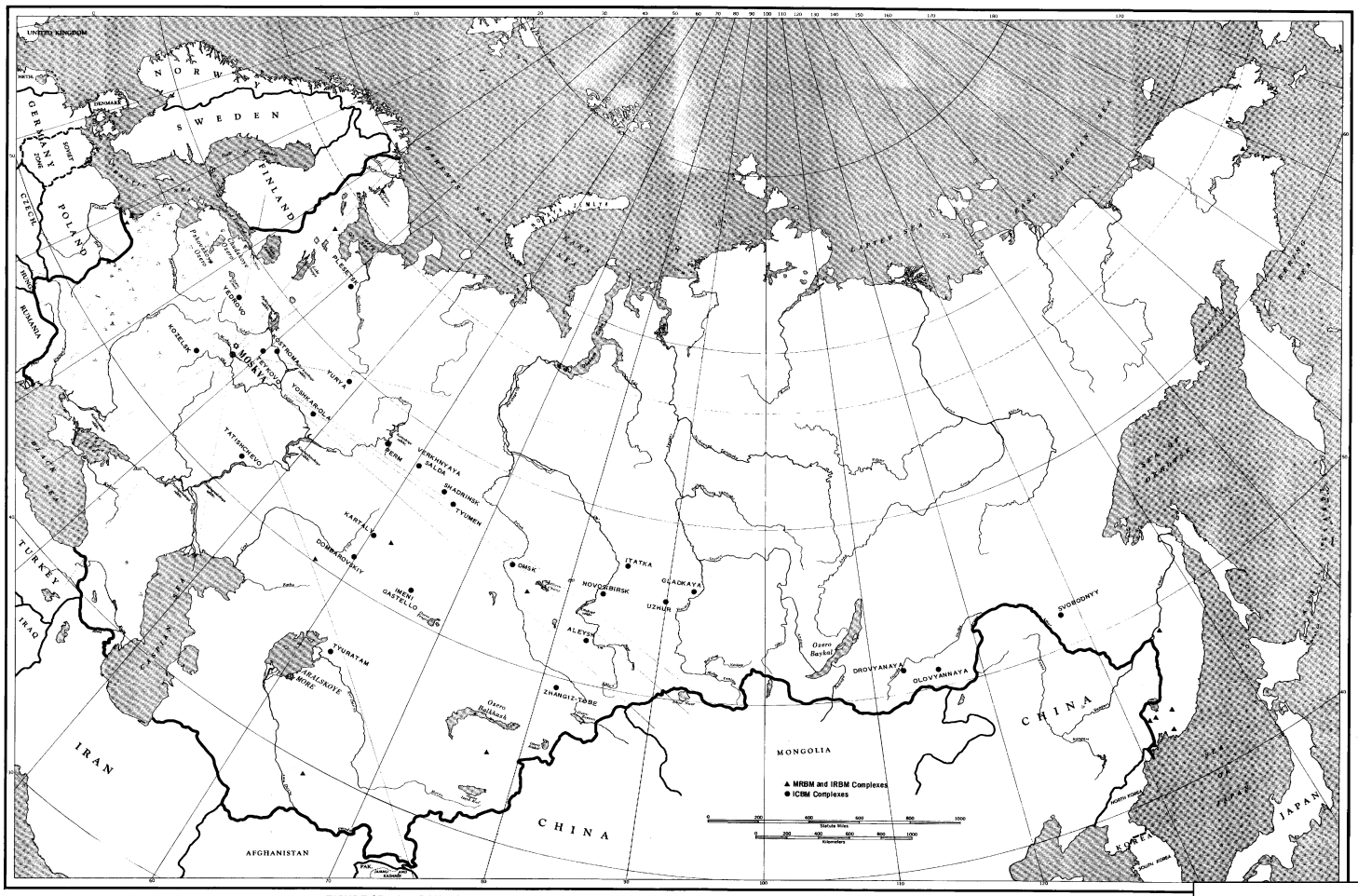


FIGURE 35. APPROXIMATE AZIMUTH PROJECTIONS OF PRINCIPAL HF ANTENNAS AND ANTENNA GROUPS AT RAMENSKOYE.

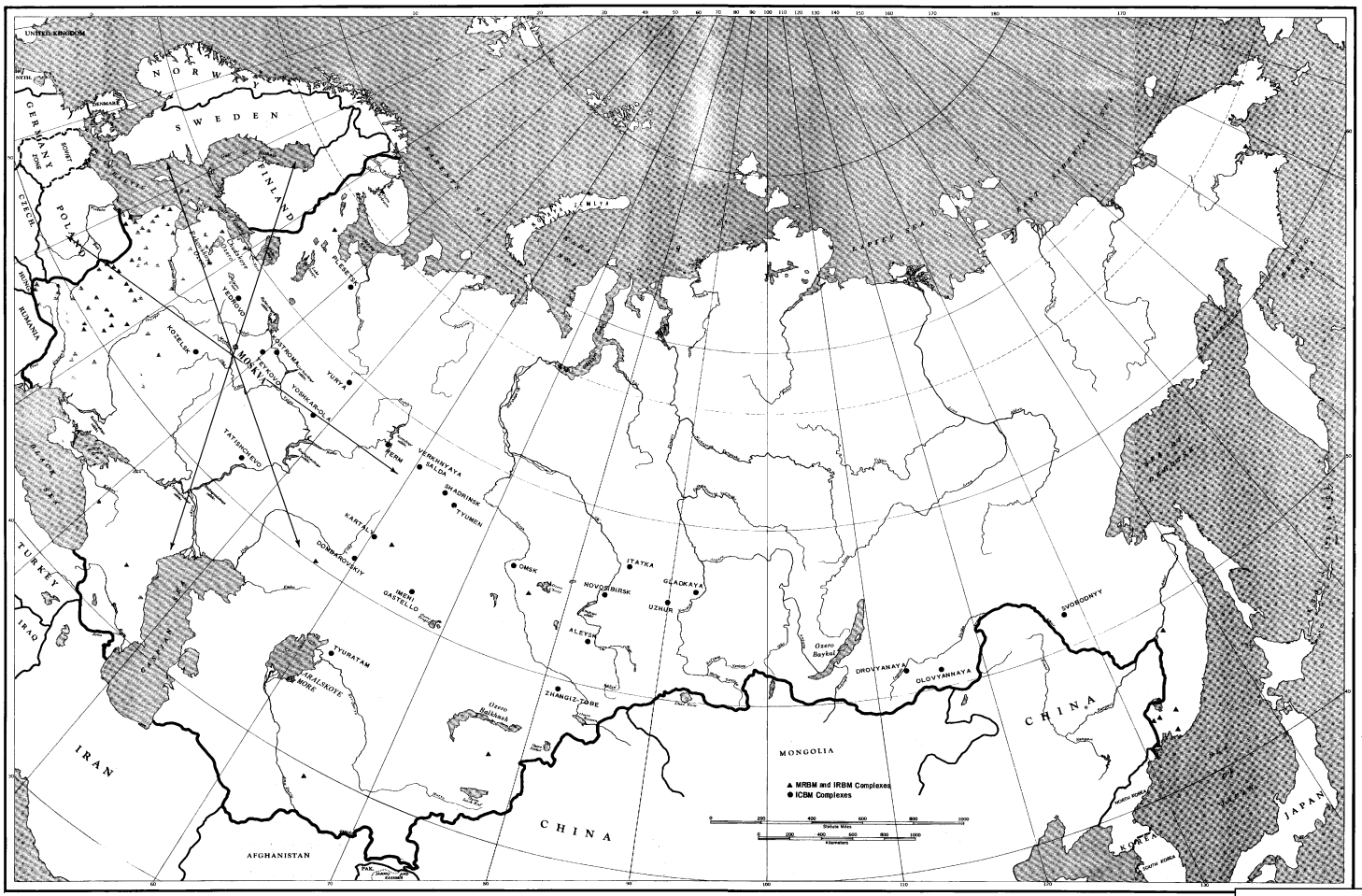
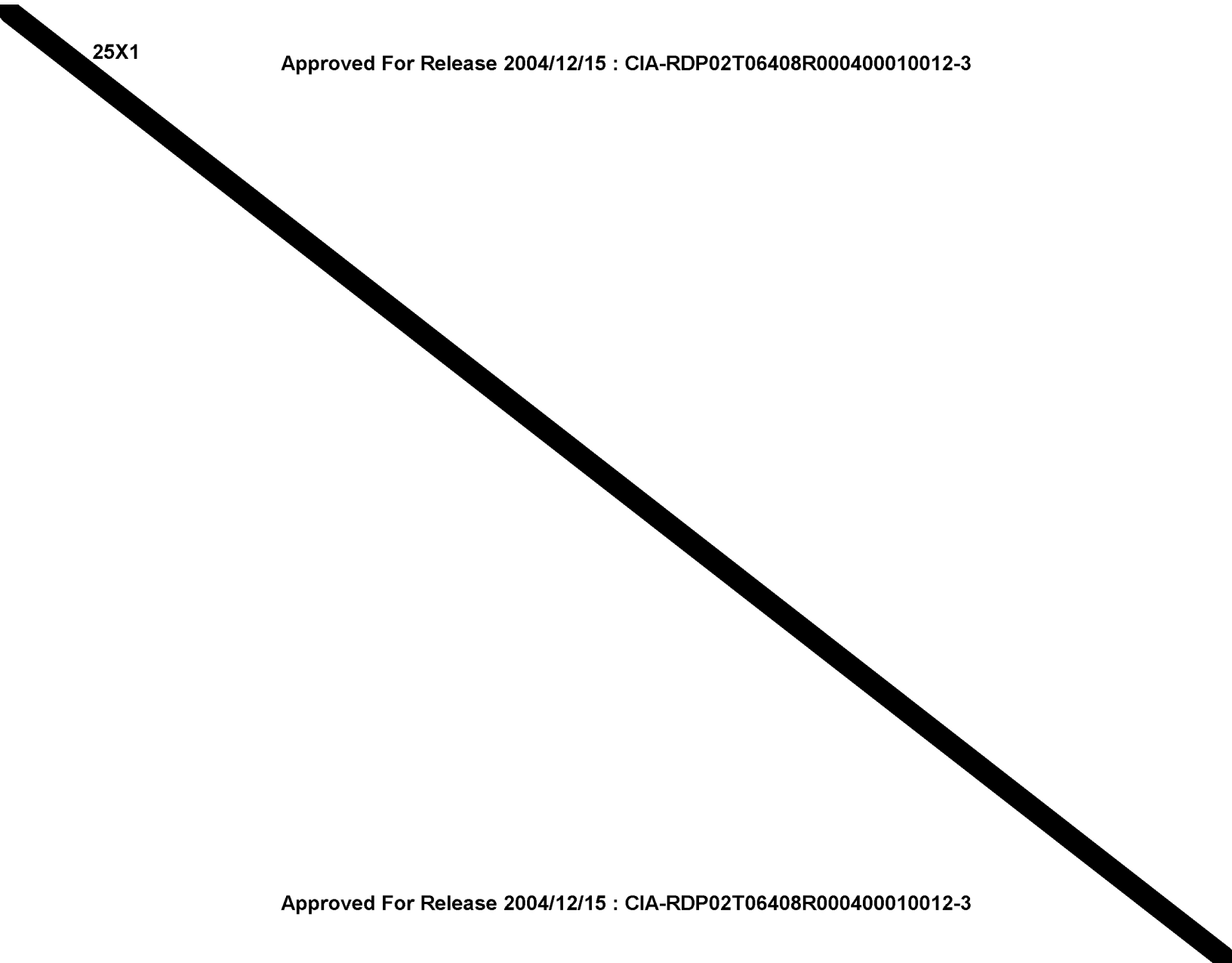


FIGURE 36. APPROXIMATE AZIMUTH PROJECTIONS OF HARDENED (SUBSURFACE) ANTENNAS AT RAMENSKOYE.



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REFERENCES (Continued)

MAPS OR CHARTS

DIA. US Air Target Chart, Series 200, Sheet 0167-4HL, 2d ed, Mar 63 (SECRET)

DIA. US Air Target Chart, Series 200, Sheet 0167-5HL, 2d ed, Apr 63 (SECRET)

DIA. US Air Target Chart, Series 200, Sheet 0167-10HL, 2d ed, Feb 63 (SECRET)

DOCUMENTS

1. NPIC. [redacted] *Nine SRF Probable Regional Headquarters Facilities, USSR,* Apr 66 (TOP SECRET [redacted]

2. NPIC. [redacted] *HF Communications Facilities at Soviet MRBM and IRBM Complexes (Update),* Jan 66 (TOP SECRET [redacted]

3. NPIC. R-795/64, *New HF Communications Facilities at Soviet MRBM/IRBM Launch Areas,* Aug 64 (TOP SECRET [redacted]

[redacted]

5. NPIC. [redacted], *Soviet SRF Probable Regional Headquarters Facilities (Supplement),* Jul 66 (TOP SECRET [redacted]

6. DIA. UPIR-9056-0226, *Perkhushkovo Missile Headquarters, USSR,* Nov 63 (TOP SECRET [redacted]

7. [redacted]

8. Institute of Electrical and Electronic Engineers, *Transactions on Antennas and Propagation, Special Issue on Electromagnetic Waves in the Earth,* Vol AP-11, No 3, May 63 (UNCLASSIFIED)

9. RADC. TR-65-233, Vol I, *A Summary Report on Tri-Service ELF Communications,* Sep 65 (SECRET)

10. RADC. TDR-64-184, Vol IA, *Hardened Antenna Studies, Electrical Investigation of Hardened HF Antennas,* Sep 64 (UNCLASSIFIED)

11. RADC. TDR-64-184, Vol IB, *Hardened Antenna Studies, Electrical Investigation of Hardened HF Antennas (Continued),* Sep 64 (SECRET)

12. RADC. TDR-64-184, Vol II, *Hardened Antenna Studies, Environmental Analysis of Hardened HF Antennas,* Sep 64 (SECRET)

13. RADC. TDR-64-184, Vol IV, *Hardened Antenna Studies, A Study of Hardened UHF Antennas,* Sep 64 (SECRET)

REQUIREMENTS

[redacted]

CIA/ORR/C-RR4-81,798-64 (partial answer)

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